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IRON ORE TRAFFIC IN 1900.

IT IS THE ALL-ABSORBING TOPIC AMONG VESSEL OWNERS AND THE REPRESENTATIVES OF MINING COMPANIES ON THE GREAT LAKES—FIGURES FROM TWO VIEWS OF THE SITUATION.

Developments of the past few days in iron ore circles on the great lakes have caused some vessel owners to feel that probably it is just as well that their vessels are bottled up for 1900 on a basis of $1.25 ore from the head of Lake Superior. As a result of what is almost a complete suspension of grain shipments, due to the demand being cut off on account of prices at which the grain is held in the west, the great bulk of the lake fleet has been turned into the ore trade at a time when the ore mines are getting around to final shipments for the season, as they aim to close up their affairs as far as possible in advance of the fall grain movement. The result has been a drop in ore freights to a basis of $1.25, or just the rate that has been paid for all of next year. Added to this is the positive assurance, from figures now in hand, that the ore movement of the present season will be full 17,000,000 tons, if not a quarter of a million tons more when rail shipments are added to the lake movement. This total of 17,000,000 tons of ore for the present season is held up, from the shippers' standpoint, as an indication of what the lake fleet can do with added railway and dock facilities next season and with additional capacity to come from the ship yards.

As this output is said to measure the lake fleet on a larger scale than was expected, it will be interesting to discuss again a summary of vessel capacity engaged for the ore trade next year, which was printed in the Marine Review of Oct. 26. Any effort to go over the immense lake fleet and say "these are the number of vessels with the capacity of each, and they will carry so much" would be useless, for the reason that the vessels are engaged in several lines of trade in which capacity differs from a great many causes. In the summary just referred to it was shown that lake vessels capable of moving next season 17,798,000 tons of ore were in the hands of the ore companies. Let us add to this the capacity of vessels owned by the Tonawanda Iron & Steel Co., which were not included in the table, and a few vessels since chartered, and we have somewhat more than 18,000,000 tons capacity either owned by the ore companies or under charter to them. Since this summary of 18,000,000 tons was made, we have gone over the entire lake fleet with a view to estimating the capacity of vessels that may be at all available as ore carriers and which have no ore for next year, and with a view also of adding to this the surplus capacity of owners who have taken only a part of what they can carry. In this way we cannot figure with very liberal allowances more than about 2,500,000 tons capacity unchartered for next year. This would mean (if allowance is made for the wooden vessels taking up coal in most cases during the greater part of the season) that the capacity of the entire fleet of vessels on the lakes that engages in the ore trade regularly and in the grain trade partly in spring and fall is not more than about 20,500,000 tons; and this including the estimated capacity of new vessels to come out during the coming year.

Now let us admit for the purpose of giving full consideration to the shipper's argument (the opposition to high freights) that there is an indefinite side to what is said in the foregoing paragraph. This will bring out another line of figures. It is settled beyond question, as already noted, that the movement of ore by lake during the present season will be full 17,000,000 gross tons. In addition to this very large ore output, there will be this season shipments of certainly 250,000,000 bushels of grain (not including flour, which is carried by vessels fitted for the flour trade). This 250,000,000 bushels of grain is in round numbers equal to about 6,250,000 gross tons. At least 65 per cent of this grain, or say 4,000,000 tons, has been moved in vessels that engage mainly in the ore trade. It follows, therefore, that the so-called ore and grain carrying fleet of the lakes is to move this season 17,000,000 gross tons of ore and 4,000,000 gross tons of grain, or in all 21,000,000 tons. This is actual business of the present year, and on these figures the shipping interests claim that the available unchartered capacity referred to in the foregoing paragraph is underestimated. Especially is this the case, they say, when it is understood that the new vessels to come out during 1900 (capable of carrying about 3,000,000 tons if in commission for the full season) will carry at least 2,000,000 tons next season. But they also present some facts relative to ore handling facilities next year that will have an important bearing on freights and which should not be overlooked. Principal among these is the very large increase that will be made in the number of cars suited especially to the ore trade between Lake Erie ports and the furnaces. It is understood that the Pennsylvania Co., with large interests at Cleveland, Ashtabula and Erie, is making unusual preparations on this score, and the added facilities will not be confined alone to cars. Ore dock improvements are also included. What is true of the Pennsylvania Co. is also true of the Lake Shore Railway Co. with its large interests at Ashtabula, the Carnegie Co. with its docks and railway at Conneaut, and the other railways that have terminals on Lake Erie. In the upper lake region the railway and dock facilities will also be largely increased, and a new feature in the situation is the provision that is being made at large furnace plants in Ohio and Pennsylvania for the storage of immense quantities of ore taken in direct shipments throughout the season of navigation, so as to save expense in transit and at the same time relieve the Lake Erie docks from a storage standpoint. All this will tend to give dispatch to vessels, especially at unloading ports, where the delays have been worse this year than for a great many years past. Thus the ore shipper argues that it will be fully as easy to move eighteen or possibly nineteen million tons of ore in 1900 as it was to move seventeen millions during the season now coming to a close; and so the vessel owner not yet under charter at all or not yet fully covered up has in the foregoing paragraphs two sets of figures and two lines of argument to choose from. No matter what the figures may show he can, of course, claim to still have the best of the situation from the fact that there is for the present at least more ore offered to vessels at $1.25 for next year.

PLACES IN THE BIG COAL COMPANY.

Affairs of the Pittsburg Coal Co. ($64,000,000 consolidation) are gradually being lined up since the directors, President Frank Osborne, Secretary Baine and other officers, have entered upon their duties. Among appointments officially announced are Geo. Schludeberg to be superintendent of mines, and Selwyn M. Taylor as chief engineer. Both these gentlemen were with the Robbins interest of Pittsburg previous to the consolidation. Mr. E. S. Saeger of Osborne, Saeger & Co. will be prominently connected with the sales department and it is quite probable that James Walsh of Walsh, Upstill & Co. of Cleveland and Wilford P. Arms of Youngstown will also have places in this department. It is understood that alike to Pickands, Mather & Co. and M. A. Hanna & Co. the lake interests known as the Pittsburg & Chicago Gas Coal Co. and Youghiogheny & Lehigh Coal Co., which are managed by G. E. Tener and John A. Donaldson, will retain their identity, although controlled by the big organization. Most of the vessel charters for the consolidation are now being made by Mr. S. H. Robbins, also of Osborne, Saeger & Co., and it is more than probable that he will have full charge of this important work very shortly.

ENORMOUS MOVEMENT OF IRON ORE.

It is now settled, almost beyond question, that the ore output from Lake Superior iron mines during the present year will exceed 17,000,000 gross tons. If the rail shipments equal last year's total of about 400,000 tons, and if the weather during the present month is favorable to the lake fleet, the output may be even 17,500,000 tons. This is more ore than was mined in the thirty-year period of shipments previous to 1882. In the period from 1890 to 1895 shipments were regarded as very heavy, but the movement of the present season is equal to that of any two seasons within the years named.

Shipments to Nov. 1 of this year, as officially reported by the dock agents, aggregate 15,560,078 tons, against 12,545,556 tons on the same date a year ago or a gain of 3,014,512 tons. The October movement this year footed up 2,543,859 tons, or about a million tons more than the shipments in October, 1898. It will be noted that if November shipments are only 60 per cent of the October movement the total for the season will be full seventeen millions. The increase extends to every shipping port in the upper lake district. Two Harbors leads with Escanaba a very close second and Duluth third. Escanaba shipments for the season thus far are so close to the Two Harbors' total, that a late movement from the Lake Michigan port may yet give it first place.

TRIAL OF THE HOLLAND.

Further trials of the Holland submarine torpedo boat have been made during the past week in Peconic bay, at Greenport, N. Y., in the presence of a naval board of inspection consisting of Rear Admiral Frederick Rogers, Commander William H. Emory, Chief Engineer Charles R. Roelker, Naval Constructor Washington L. Capps and Lieut. Richardson Henderson. No expression of opinion was heard from members of the trial board, but the fact that at the conclusion of the run they went on board the steam yacht Josephine and congratulated John P. Holland, the inventor, is possibly not without some significance. The Holland's first run was made with John Lowe and Commander Emory on board. The vessel made a quick dive and ran the course of one mile with a flying start, submerged, covering the distance in 9¼ minutes. She then came to the surface and a Whitehead torpedo was fired, striking the target fairly. In 10 seconds the Holland was again submerged and turned in a radius of 75 feet. Lieut. Henderson and Naval Constructor Capps went on board the boat later in the afternoon and she made a ¾-mile submerged run. At the end of this run, while 10 feet under water, a torpedo was fired, which also made the target. The speed trial developed 8 knots.

Within a few days the Detroit Ship Building Co. will launch at its Wyandotte yard steamer No. 133, building for the American Steamship Co. (Senator McMillan, A. McVittie and others of Detroit), and which will, of course, be ready to go into service immediately upon the opening of navigation next spring. This steamer is a duplicate of the Angeline, recently completed for the Presque Isle Transportation Co. (Mr. W. G. Mather and others) of Cleveland. She is 435 feet over all, 50 feet beam and 28 feet molded depth. Engines are of about 1,450 horse power—triple expansion with cylinders of 22, 35 and 58 inches diameter and 42 inches stroke. The boilers (two of them) are 13 feet 2 inches diameter and 11 feet 6 inches length, having 40-inch furnaces and fitted with Howden hot draft appliances. The lighting equipment of this vessel will include electric mast-head and side lights, and she will have steel spars, steam windlass and capstans, steam steering gear, stockless anchors and in fact everything in the way of modern equipment that is found on the best of the lake freighters.

The $1,815 bid of the James Reilly Repair & Supply Co. of New York City was the only one received at the office of the general superintendent of the army transport service for making deck repairs on the United States army transport McPherson.

THE ADMIRALTY CO-EFFICIENT WITH FACTS GLEANED FROM TORPEDO BOAT STEAM TRIALS.

BY WILLIAM A. FAIRBURN.

In the early stages of a steamship design a close approximation has to be made to the indicated horse power which will be required to propel the proposed vessel at the required speed. All naval architects use some simple formula for their first approximation of power. It is quite evident that any formula by means of which the power to drive a vessel at a certain speed can be derived, must contain one or more co-efficients. These co-efficients cannot have a constant value in ships of different types, for the wave-making, frictional and eddy-making resistance will vary in ships of different fineness, size and speed. Weight has nothing to do with the resistance of a ship, but the amount of water displaced and the method of displacing it has to be seriously considered, and it is quite apparent that a full bodied cargo steamer driven to her maximum speed must have a different co-efficient in any power formula from the fine ocean greyhound of the same size but which is steaming easily at a similar speed. Again let us suppose that a 250-foot ship of a certain type and fullness has a speed of say 12 knots per hour, it is quite evident that a similar ship of twice that length—500 feet—and of the same fullness will at the same speed have a better co-efficient in any power formula than the smaller vessel.

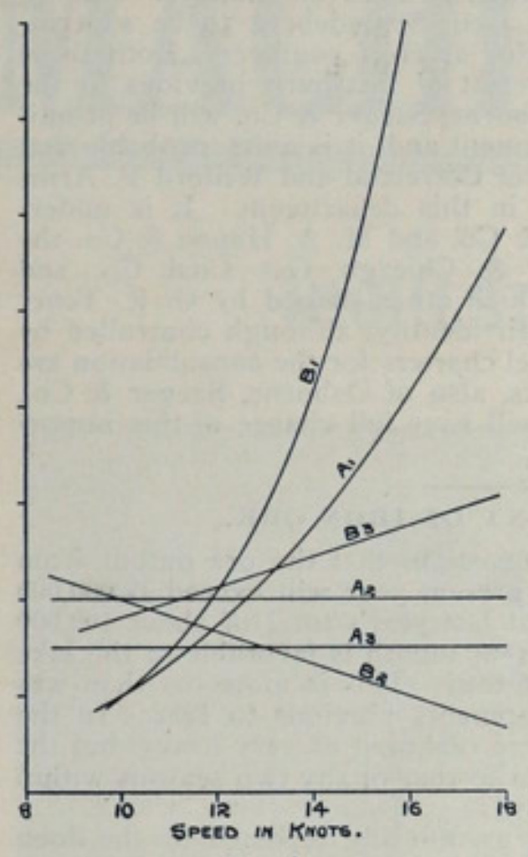


FIG. 1.

No power formula therefore can be deduced that will have a constant co-efficient applicable to vessels of different types, size and speed. All formulae designed to determine the I. H. P. required to drive a vessel at a certain speed must be used in conjunction with accurate speed and power trial data. Vessels are designed today by figures based on existing successful vessels before a single line is drawn on paper. Data of known ships concerning weights, capacity and cost are invaluable to the naval architect, but accurate speed and power data is usually considered the most valuable of all. To make any estimate of I. H. P. for a proposed ship approximately correct, the co-efficient used in the power formula must be one obtained from a similar vessel at a similar speed. The nearer the vessels, proposed and actual, agree, the more accurate the approximation of power will be, therefore the value of accurate speed and power data will be readily seen.

The Admiralty co-efficients of performance are the most popular power formulae used by naval architects today. They have been used since the early days of steamship construction, and although no great skill was necessary in using them many years ago, they are dangerous formulae for a novice to handle today. As the speed of vessels increase the flaws in all speed and power formulae become more pronounced, and this is all due to the fact that whereas frictional resistance can be calculated, wave-making resistance can only be determined by experiment. When the Admiralty co-efficients first came into use the speed of steamships was so low that wave-making resistance was insignificant, and a formula based on wetted surface with resistance varying as the square of the speed, could not be greatly in error. It will be well to here state that a certain 4,000-ton steamship, known to the writer, at 10 knots speed has only 8 per cent of her total resistance due to wave-making, but at 20 knots speed this is increased to over eight times that amount. At speeds of from 6 to 9 knots per hour, with clear bottoms, frictional resistance usually represent from 85 to 90 per cent of the total resistance. At full speed in ships steaming at high speeds, say 18 to 22 knots per hour, friction has a less proportional effect, but it still represents from 45 to 55 per cent of the total resistance. The formulae to determine the Admiralty co-efficients of performance are as follows: Let D=displacement of ship in tons; A=immersed area of midship section in square feet; V=speed in knots per hour; P=indicated horse power; C=Admiralty co-efficient. Then:

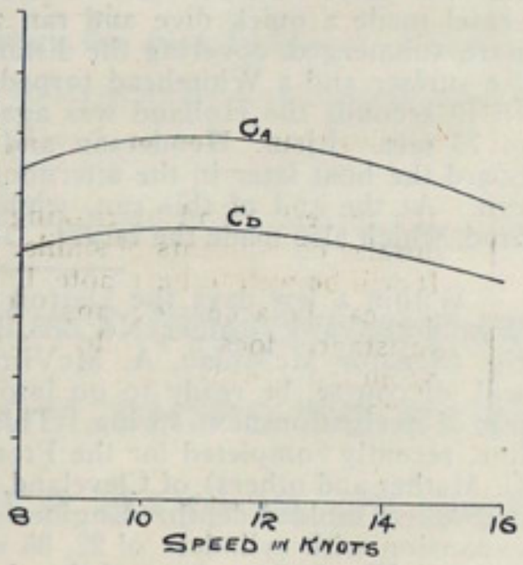


FIG 2

C_D=Admiralty displacement co-efficient=$\frac{D^{\frac{2}{3}} \times V^3}{P}$

and C_A=Admiralty midship section co-efficient=$\frac{A \times V^3}{P}$

In these expressions it is assumed: 1. That the resistance of the ship varies as the square of the velocity, and the work to be done in propelling her varies as the cube of the same. 2. That for similar ships the resistance corresponding to a certain speed will vary as the immersed area of the midship section or as the two-third power of the displacement 3. That the efficiency of the machinery remains constant or that the effective horse power or useful power required to overcome the "tow rope resistance" will vary as the indicated horse power. The Admiralty formulae therefore assume that the resistance of a ship consists of skin or frictional resistance only, and that it varies as the square of the speed. We know, however, that although the resistance of a ship at low speed is almost wholly due to friction, yet at high speeds it is often only one-half or one-third of the total resistance. Moreover, as the speed increases, the law of variation in ordinary ships involves a higher power than the square of the speed. If the resistance consisted of skin friction only, then the resistance would undoubtedly vary as the wetted surface. For similar ships of varying sizes the wetted surface which we will call S, varies as the square of the linear dimensions. Now $D^{\frac{2}{3}}$ is proportional to the square of the linear dimension, and therefore to the wetted surface, as is also A. Let R denote resistance. Then $R=C.S.V^2$ when C is a constant. If the efficiency of propulsion remains constant $P=R.V.=C.S.V.^3$. As S varies as $D^{\frac{2}{3}}$ and A, it follows that for similar ships we have $P=D^{\frac{2}{3}}.V^3.C$ or $P=\frac{D^{\frac{2}{3}}.V^3}{C_D}$ and $P=A.V^3.C$ or $P=\frac{A.V^3}{C_A}$

C_D and C_A the Admiralty co-efficients, based on the displacement and the area of immersed midship section respectively, being constant. These formulae can, of course, be written in several ways:

$C_D=\frac{D^{\frac{2}{3}} \times V^3}{P}$ $\quad P=\frac{D^{\frac{2}{3}} \times V^3}{C_D}$ $\quad D=\sqrt{\left(\frac{P \times C_D}{V^3}\right)^3}$ $\quad V=\sqrt[3]{\frac{P \times C_D}{D^{\frac{2}{3}}}}$

$C_A=\frac{A \times V^3}{P}$ $\quad P=\frac{A \times V^3}{C_A}$ $\quad A=\frac{P \times C_A}{V^3}$ $\quad V=\sqrt[3]{\frac{P \times C_A}{A}}$

These formulae may be taken to apply approximately to ships which are not similar and whose efficiencies of propulsion differ, but, as before stated, the greater the similarity in hull, speed and machinery, the greater will be the degree of accuracy possible with this method of approximating speed and power.

Frictional resistance depends on wetted surface, therefore, if the proportions of a ship be changed, even if the lines have the same character and the changes are made only in the scale, the Admiralty co-efficient may be expected to differ. This is because the wetted surface does not vary as $D^{\frac{2}{3}}$, except for precisely similar ships. For instance, a vessel 160 feet long, 30 feet beam and 15 feet draught has a displacement of 1,000 tons and 6,250 square feet of wetted surface. The value of $D^{\frac{2}{3}}$ is 100. If we keep the lines the same and change the scale so that the length of a new vessel is $160 \times 3 = 480$ feet; and the beam $30 \times 1.5 = 45$ feet and the draught remains the same, viz., 15 feet, the new ship will have a displacement of 4,500 tons and a wetted surface of about 23,000 square feet. The

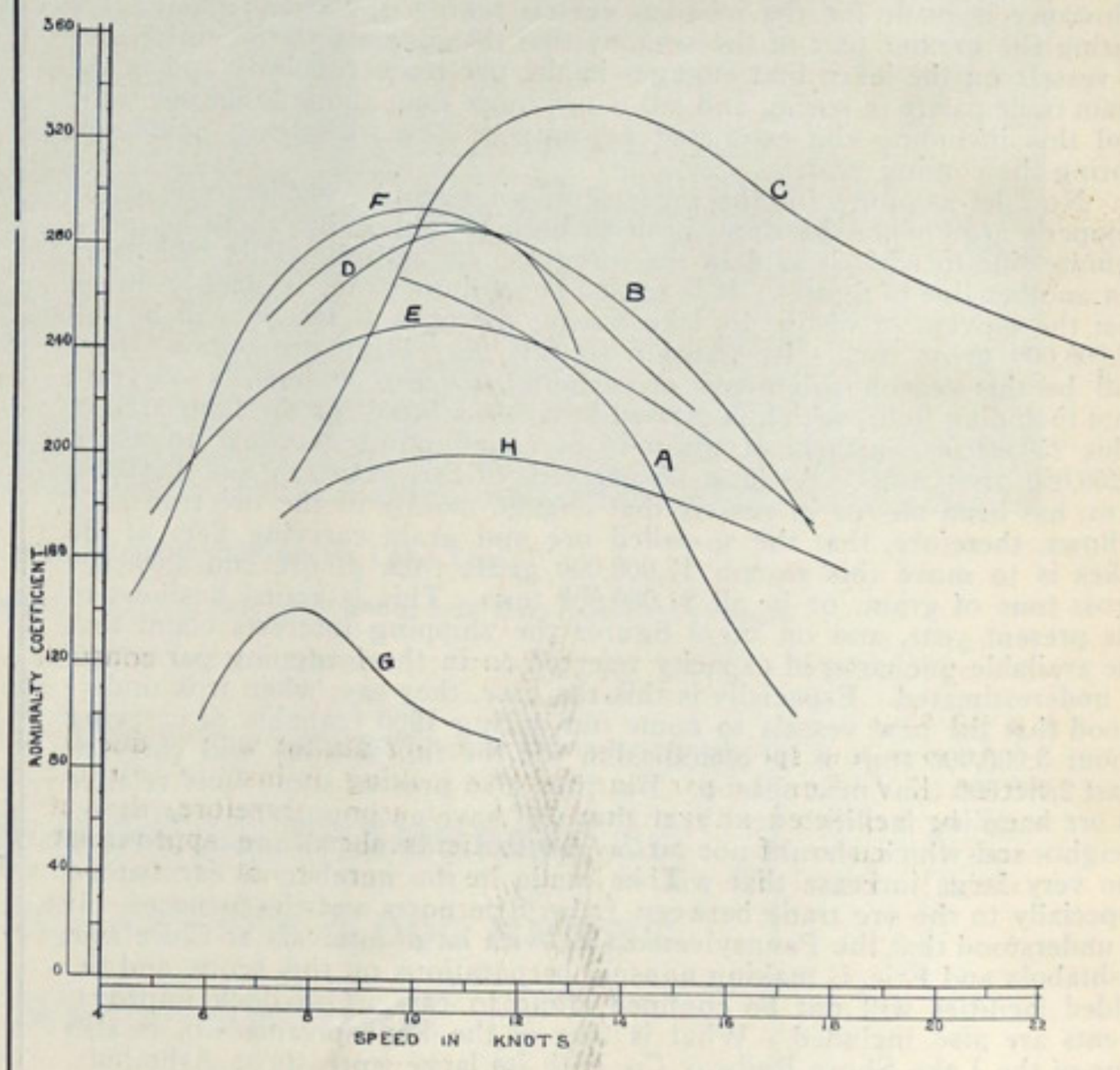


FIG 3.

value of $D^{\frac{2}{3}}$ of the larger ship is 272, which is 2.72 times that of the smaller vessel, but the wetted surface instead of being $6,250 \times 2.72 = 17,000$ feet, is 23,000 feet. The ratio of the $D^{\frac{2}{3}}$ is as 1 : 2.72, but the ratio of the wetted surface of the two ships is as 1 : 3.68. It therefore follows that in vessels of very different proportions the Admiralty co-efficient cannot be used with any degree of accuracy, for in such vessels the wetted surface and the resistance due to friction does not vary as the $D^{\frac{2}{3}}$

If the resistance of a ship varied as the square of the velocity, the "curve" of Admiralty co-efficient calculated from the I. H. P. curve would

be a straight horizontal line, for the co-efficient would be a constant. The curve marked A, Fig. 1, shows an I. H. P. curve for a visionary ship which has a constant Admiralty co-efficient for all speeds. This curve of power is, therefore, a cubic parabola. The "curve" A_1, which is a straight horizontal line, is the Admiralty co-efficient "curve." If we plot the power curve in functions of the speed we obtain the "curve" A_3, which must of necessity be a straight horizontal line when the Admiralty co-efficient "curve" is straight and horizontal, for the latter assumes the resistance to vary as the square of the speed and the power to overcome the resistance, as the cube of the same. No vessel has ever been built, however, the resistance of which varied constantly and uniformly as the A curves in Fig. 1 show. The "curve" of Admiralty co-efficient, therefore, can never be straight. It must curve from the horizontal, and the wave-making resistance of the ship, which determines whether the total resistance varies as the square, cube, or fourth power of the speed, will also determine the rise or fall of the Admiralty co-efficient curve above low speeds. The curves marked B, B_2 and B_3, Fig. 1, are similar curves for a ship of the same displacement as A, but assuming the model and machinery to be such that the Admiralty co-efficient varies from a certain value to 10 knots to one-half that value at 16 knots. It will be seen that as the "curve" of co-efficients lowers, the curve of speed exponents raises. As a general rule for medium speeds the power curve expressed in functions of the speed will resemble somewhat the Admiralty co-efficient curve inverted.

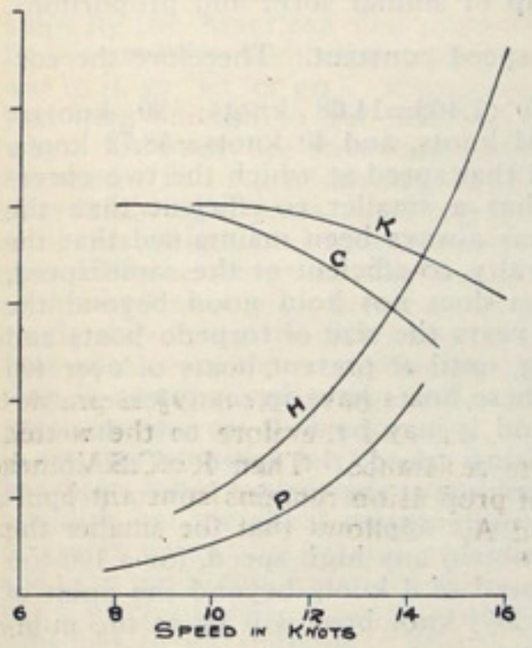


FIG 4.

We have already seen that the resistance of a ship does not vary uniformly as the square of the speed, and it may be of interest to see how the resistance does vary in representative vessels of different classes. An armed low freeboard vessel of peculiar form driven a good deal beyond her economic speed, has, at 16 knots, resistance varying as the sixth power of the speed. An 11,000-ton battleship at 17 knots has resistance varying as the fifth power of the speed. The resistance of an ocean tramp steamer at 12 knots varies as the fourth power. Several small cruisers and gunboats at speeds given approximately by the formula $V=\sqrt{L}$ when L is the vessel's length, show a speed exponent of about 3. A small inland passenger steamboat at 10 knots speed has resistance varying at the 3.5 power, while an ocean-going cargo and passenger steamship of 10,000 tons displacement at 20 knots has a speed exponent of about 3. The progressive speed trials of all the above vessels, excluding the river steamboat, show that at 10 knots, the resistance is varying at about the square of the speed. It must be borne in mind that if the resistance varies as the square of the speed, the I. H. P. to overcome this resistance varies as the cube $R=C.V^2$, $P=R.V=C.V^3$; therefore when we find that the resistance varies as the fifth power of the speed, it must of necessity follow that the I. H. P. to overcome this resistance varies as the sixth power.

But let us look into this matter a little closer. The resistance of a ship, as before stated, is made up of three parts—frictional, wave-making and eddy-making. The latter can be neglected, for in modern boats it is almost inappreciable. Frictional resistance varies as the wetted surface and the 1.83 power of the speed, and it can be expressed mathematically thus: $R_f=C.S.V^{1.83}$ when C is a constant varying with the nature and extent of the surface. The wave-making resistance cannot be expressed mathematically, but we will assume that it varies as the 3.5 power of the speed. Then the total resistance of a ship can be expressed thus:

$$R=C.S.V.^{1.83}+K\,V^{3.5}.$$

The effective horse power would be $E\,P=C.S.V^{2.83}+K\,V^{4.5}$ and if E represents the propulsive co-efficient or the ratio of the power to overcome the "tow rope resistance" to the power indicated in the engine cylinders $\frac{1}{e}=E$, then the indicated horse power could be written:

$$P=(C.S.V^{2.83}+K\,V^{4.5})\,E. \quad \text{Now } P=\frac{D_{\frac{2}{3}}^{\frac{2}{3}}\times V^3}{C_D}, \text{ and substituting and}$$

reducing we get $C_D=Q\frac{V^3}{C.S.V^{2.83}+K\,V^{4.5}}\,E$ where Q is constant for a given ship.

At very low speeds, the resistance being almost wholly due to skin friction, $K.V^{4.5}$, or the part due to wave-making, is insignificant and can safely be neglected altogether. It would seem, therefore, that at low speeds the curve of Admiralty co-efficients should be approximately a straight horizonal line. This would be so were it not for the value E. This propulsive co-efficient is at low speeds a very variable quantity. It is very small at low speeds but it increases rapidly with the speed up to a certain point, which is usually in merchant vessels at a speed that requires about one-fourth of the trial I. H. P. In naval vessels, where short stroked well-designed engines of high piston speed are used, this point is reached earlier or at one-sixth to one-seventh full power, and in torpedo boats and destroyers it is reached still earlier. When the great disadvantage of large machinery working at low power is overcome, the Admiralty co-efficient curve will have a tendency to run horizontal, but the speed, which has been gradually increasing, will probably about this time be such that the wave-making resistance begins to assert itself. As the term $KV^{4.5}$ in the denominator increases, the curve of Admiralty co-efficients will drop, and E will increase but very slightly until it is practically constant for all high speeds. The result is that the curve of co-efficients must reach a maximum value at some low speed and then gradually decrease in value as the speed increases.

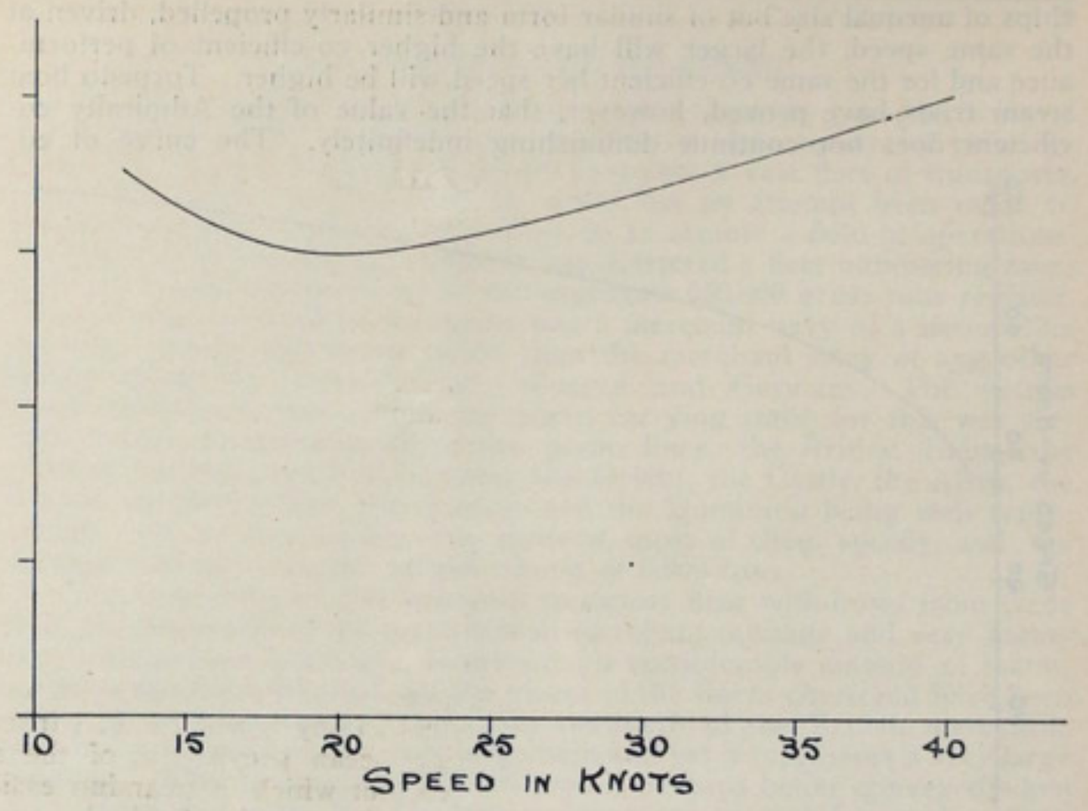


FIG 5.

Fig. 2 shows curves of C_D and C_A calculated from the I. H. P. curve of a successful screw steamer. It will be seen that these curves are exactly similar, the only difference being in the scale. For as $C_D=\frac{D_{\frac{2}{3}}^{\frac{2}{3}}\times V^3}{P}$ and $C_A=\frac{A\times V^3}{P}$, therefore $\frac{C_D}{C_A}=\frac{D_{\frac{2}{3}}^{\frac{2}{3}}\times V^3\times P}{P\times A\times V^3}=\frac{D_{\frac{2}{3}}^{\frac{2}{3}}}{A}=$ a constant for a given ship. Of the two co-efficients, that based on the displacement is, without doubt, the more satisfactory and trustworthy, for it gives a fairer measure of the resistance than does the midship section co-efficient. It may be interesting to state that French naval architects generally use the reciprocal of the midship section co-efficient with success. They are aware, however, of its many imperfections and their success is due to the possession of accurate data, taken from all types of vessels, and to their own good judgment and experience in handling.

Fig. 3 shows some interesting Admiralty co-efficient curves calculated from the I. H. P. curves of representative vessels of various types. A is the curve of a coast defense vessel which has a small amount of wetted surface but very full bow lines; B is a first-class battleship; C a large Atlantic liner; D a modern cargo steamship, light, with water ballast; E a third-class cruiser; F a gunboat; G a small tow boat, and H a modern steam yacht. We have seen that the curve of Admiralty co-efficients in all vessels gradually increases from a very small value at low speeds, until a certain speed is reached, which requires usually in merchant vessels about one-fourth of the trial I. H. P. At this point the curve of co-efficients is a maximum. It then gradually decreases and in well-formed, high-speed vessels it runs almost straight, though inclined downwards. Until quite recently it was thought that the curve would continue to drop indefinitely, and therefore the higher the speed the more costly a further increase of speed would prove, no matter how excellent the model might be. Froude's law of comparison, which is now generally accepted and the accuracy of which is proved almost daily by tank experiments and speed trials, says that the wave-making resistance of ships of similar model, but of different size, will be to each other as the ratio of the displacements or as the linear dimensions cubed, not at the same speed, however, but at corresponding speeds connected by the relation $V^2=Z\,V^2$ where Z is the ratio between the linear dimensions of the two ships.

It is not the purpose of this article to deal at length with Froude's law of comparison, but let us rapidly examine the relation of the Admiralty co-efficient to this law.

We have $P_1=\frac{D_{1\frac{2}{3}}^{\frac{2}{3}}.\,V_1^3}{C_{D1}}$ and $P_2=\frac{D_{2\frac{2}{3}}^{\frac{2}{3}}.V_2^3}{C_{D2}}$ Whence $\frac{P_1}{P_2}=\frac{C_{D2}}{C_{D1}}.\,\frac{D_{1\frac{2}{3}}^{\frac{2}{3}}.\,V_1^3}{D_{2\frac{2}{3}}^{\frac{2}{3}}.\,V_2^3}$

If D_1 and D_2 are similar ships and V_1 and V_2 are corresponding speeds, then from the law of comparison we have $\frac{P_1}{P_2}=\frac{D_{1\frac{2}{3}}^{\frac{2}{3}}.\,V_1^3}{D_{2\frac{2}{3}}^{\frac{2}{3}}.\,V_2^3}$. Therefore it follows that $\frac{C_{D2}}{C_{D1}}=1$ or $C_{D2}=C_{D1}$.

We therefore find by making a few allowable assumptions, that the Admiralty co-efficients of similar ships at corresponding speeds are identical. It will be well to here note, however, that the real Froude law of comparison can be accurately applied to wave-making resistance only. Frictional resistance does not follow the Froude law, and yet the value of corresponding speeds, etc., is so apparent that a formula which in reality assumes the total resistance of a ship to consist of skin friction is by means of these truths raised from a position of uncertainty and unreliability and made part of the great law of extended comparison.

Fig. 4 shows the I. H. P. curve marked P of a certain vessel which we will designate as A, from which the Admiralty co-efficient curve C is computed. It is required to know the power which it will take to drive a vessel B, which is larger than A though of similar form and proportions at various speeds. Then $\frac{\sqrt[3]{\text{Disp. B}}}{\sqrt[3]{\text{Disp. A}}}=Y$ and $\sqrt[2]{Y}=$speed constant and speed A $\times$ speed constant=speed B. The value of the Admiralty co-efficient for speed A can therefore be taken from the curve C and plotted at speed B, forming one point in a new curve of co-efficients for the larger vessel. Curve K shows such a completed surve, and from this co-efficient curve the I. H. P. curve marked H of the new vessel can be easily computed. From this rapid investigation it follows that for two

ships of unequal size but of similar form and similarly propelled, driven at the same speed, the larger will have the higher co-efficient of performance and for the same co-efficient her speed will be higher. Torpedo boat steam trials have proved, however, that the value of the Admiralty co-efficient does not continue diminishing indefinitely. The curve of co-

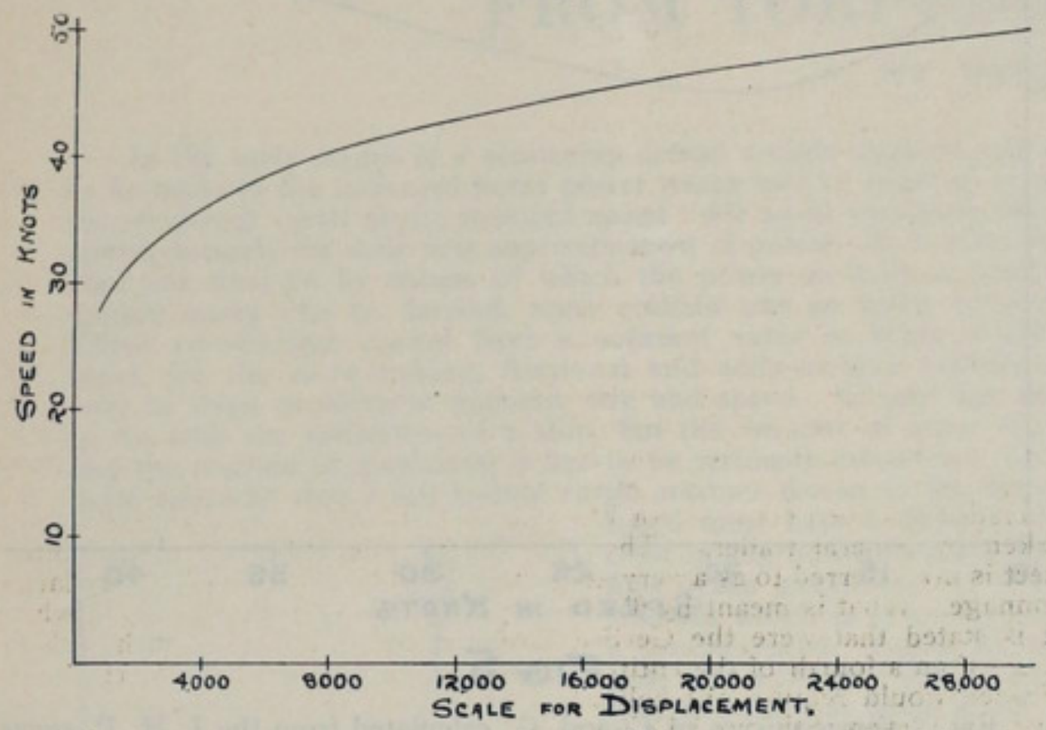


FIG. 6.

efficient reaches a minimum at a certain speed, which we will call the rising speed. The increase in the value of the co-efficient beyond the rising speed is due to a bodily rising of the vessel out of water and a consequent lessening of the displacement and wetted surface. The direct resistance is proportioned to $D^{\frac{2}{3}} V^2$ and the phenomena of rising occurs when the ratio of the direct resistance to the displacement

$\frac{D^{\frac{2}{3}} . V^2}{D} = \frac{V^2}{D^{\frac{1}{3}}}$ attains a certain value.

Fig. 5 shows the Admiralty co-efficient of a modern high-speed torpedo boat. Mons. Normand found that in the Forban, a French torpedo boat of 125 tons displacement, the minimum value of C, occurred at a speed of about 20 knots. Above this the value of the co-efficient increased, and at 31 knots, 11 knots beyond the minimum, it was still steadily rising. $\frac{V^2}{D^{\frac{1}{3}}} = \frac{400}{5} = 80$. The speed of minimum efficiency is therefore approximately given by the formula $V = 9^6\sqrt{D}$ —assuming 9 to be the square root of 80.

The value of the above co-efficient will probably vary somewhat with different types and sizes of vessels, but for torpedo boats the writer has found by experience that the constant or co-efficient 9 is applicable to almost all modern torpedo craft and small high-speed vessels. The following figures will prove interesting, as they give the speed of minimum efficiency and the speed at which torpedo boats and destroyers will commence to rise out of water:

Displacement.	Rising Speed.
25	15.4
50	17.3
100	19.4
150	20.7
200	21.8
300	23.3
400	24.4
500	25.4

Fig. 6 shows the approximate rising speeds of ships up to 30,000 tons displacement using the same co-efficient 9 in the formula given above.

When the United States harbor defense ram Katahdin was being constructed, naval architects were almost unanimous in the opinion that she would rise out of water forward when driven at full power, and therefore great speed was predicted. Actual speed tests proved that she did not

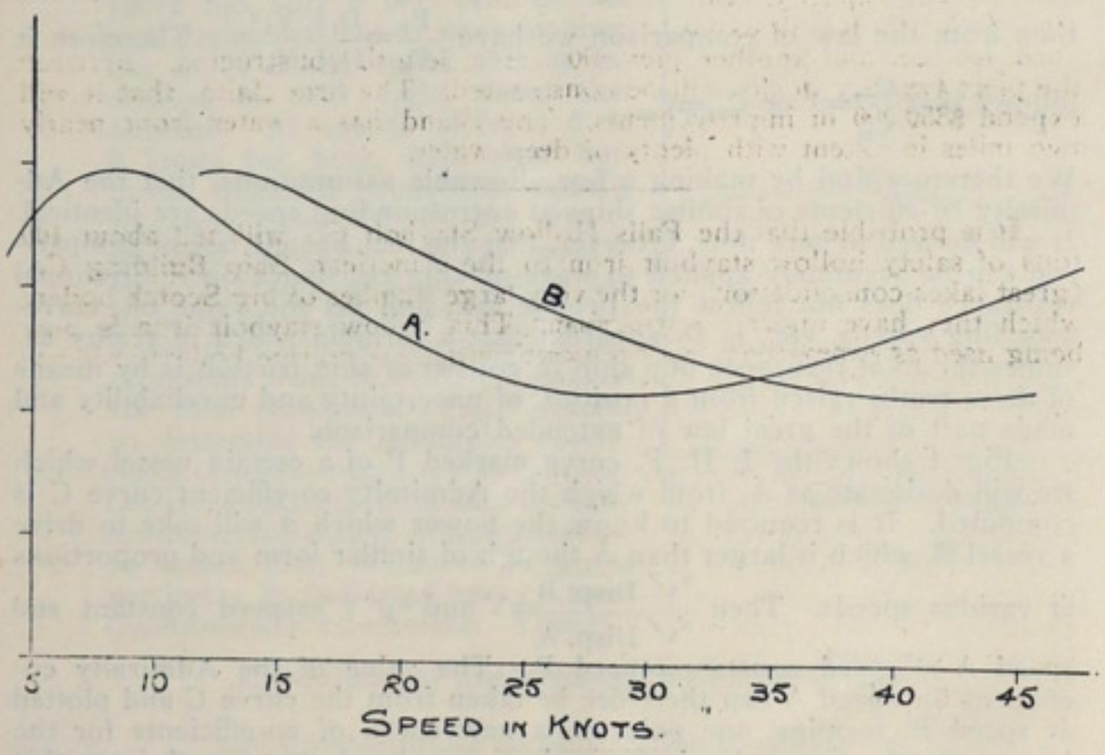


FIG 7.

change her trim at all when the false above-water bow kept the solid water from piling up on her forward deck. When the false bow was removed, the weight of water carried forward depressed the bow somewhat and there was certainly not the faintest natural tendency to rise manifested. It is not surprising that the Katahdin refused to act as predicted, for the rising speed of a vessel of her displacement is in the vicinity of 32 knots, and the maximum speed of the vessel was only 16½ knots per hour.

Fig. 7, curve A, shows an Admiralty co-efficient curve for a 1,000-ton visionary ship continued beyond the rising speed. Curve B is the co-efficient curve for a 10,000-ton ship of similar form and proportions. $\frac{\sqrt[3]{10{,}000}}{\sqrt[3]{1{,}000}} = 2.154$ and $\sqrt{2.154} = 1.468$ = speed constant. Therefore the corresponding speed of 10 knots is $10 \times 1.468 = 14.68$ knots; 20 knots = $20 \times 1.468 = 29.36$ knots; 30 knots = 44.04 knots, and 40 knots = 58.72 knots. It will be at once noticed that beyond that speed at which the two curves A and B intersect the larger ship has a smaller co-efficient than the smaller ship at the same speed. It has always been maintained that the larger the ship the higher the Admiralty co-efficient at the same speed, but it will be seen that this assertion does not hold good beyond the vicinity of the rising speed. Of late years the size of torpedo boats and destroyers has been rapidly increasing, until at present boats of over 400 tons displacement are being built. These boats have in many cases a designed speed of 28 knots per hour, and it may be well to note that this speed is within three knots of the rising speed, the speed of minimum efficiency. Aside from weight, and looking at the matter from a propulsive standpoint only, it becomes then quite apparent that the smaller the torpedo vessel the easier it will be to obtain any high speed, for a 100-ton 25½-knot boat will have reached a speed of 6 knots beyond the point of minimum efficiency when a 500-ton, 25½-knot boat will be at the minimum of the Admiralty co-efficient curve.

It follows, therefore, that the larger the boat the higher will be the Admiralty co-efficient, provided the rising speed is not reached, but if this speed be exceeded, the larger the boat the smaller will be this co-efficient. If the difference in size between two similar ships be very great, the point of intersection of the two Admiralty co-efficient curves will be at a speed a few knots beyond the rising speed. As the difference in size becomes less, the point of intersection will approach the rising speed of the smaller ship. Naval architects have not yet begun to appreciate the importance of the rising speed. The builders of a number of torpedo boat destroyers will become better acquainted with it before long, and before many years the builders of fast yachts and passenger steamers will undoubtedly feel interested in it and endeavor to keep away from its detrimental influences as much as possible.

THE NAVAL WIRELESS TELEGRAPHY TESTS.

Tests which officials of the navy department are making with the Marconi system of wireless telegraphy will extend over a period of two weeks or more, and probably no definite statement as to the results will be obtainable until the navy board of equipment is enabled to make public the report of the special board detailed for the observation of the experiments. It is known, however, that the preliminary tests were highly satisfactory. The cruiser New York and the battleship Massachusetts, the two vessels fitted with the wireless apparatus, lay in the North river, New York, about 48 yards apart, or about the distance that would separate vessels steaming in squadron formation. The sending instrument was operated on the flagship by Signor Marconi personally, while the receiving was done on the Massachusetts, the instrument being operated by one of the inventor's assistants. The particular object of the tests was to determine the practicability of using the system for short signaling while squadrons are at sea, and its adaptability for this work was proven admirably.

Six tests were made, beginning with the sending of a newspaper article of 1,500 words, which was transmitted without a single error. The rate was eleven words per minute, a little over half the average speed maintained on the ordinary instruments, but Signor Marconi explained that this speed could be greatly increased and that the instruments had, indeed, during the yacht races, transmitted at the rate of sixteen words per minute. The speed, he said, depended simply upon the speed of the operator. The message after being sent to the Massachusetts, was reported back to the New York, the words being registered on tape which was taken by the inspectors and filed away. The second test consisted of the sending of a series of numbers of varying lengths. The third test was on the transmission of a series of letters, written and drawn at random. The fourth was made up of the transmission of short messages, and the fifth and sixth tests consisted of the transmission of a series of code messages. The vessels then proceeded to sea for further tests. A feature of the tests at sea will be the firing of the big guns of the battleships while the messages are being sent, in order to determine the usefulness of the system during an engagement.

In a circular just issued relative to his Paragon boiler, which is used on several canal steamers and yachts, as well as numerous other small vessels, Capt. M. De Puy, patentee and sole owner, quotes Manager W. G. Nourse of the Marine Iron Works, Chicago, as saying: "It is the best boiler on the market"; and Charles Riter of the Eagle Boiler Works, Buffalo: "It is the best plan of a boiler I ever saw. There is not a weak point in its construction; not over expensive; can be kept clean; will be durable; and in case repairs are ever needed, every part of the boiler is get-at-able."

The Roberts Safety Water Tube Boiler Co. of New York has not figured very prominently in the discussion that has been going on for a long time regarding the respective merits of cylindrical and water tube boilers for ships of war, big merchant steamers, etc., but that company keeps on turning out great numbers of boilers for vessels and paying dividends just the same. The Roberts company has just paid a ninth consecutive annual dividend of 10 per cent on its capital stock, commencing with the year of organization (1890) and continuing through all the panic years.

SENATOR HANNA ON OUR MERCHANT MARINE.

If something is not done to enlarge the scope of our merchant marine we must either curtail our production or find new markets. Which will you have? The Hanna-Payne bill was introduced simply because we have been subservient to the shipping interests of Great Britain. I can only account for Democratic opposition to that bill because my name was connected with it, and because I don't think they know anything about it. I don't believe that there is a single member of the committee which drew up the plank condemning this measure in the Ohio Democratic platform that knows the stem from the stern of a ship, or how many ships fly the American flag upon the high seas as a merchant marine or knows anything about the subject embraced therein. But Hanna's name was to it, so "let 'er go." Hanna's name is still there and it will stay there just long enough to get that bill passed, I hope. And I will tell you why. As I say, we have been subservient to Great Britain in shipping interests. The American flag has been wiped off the high seas for more than thirty-eight years. Our merchant marine has been fading and fading, until it is all gone. In the immense traffic through the Suez canal in the year 1898 the American flag was seen but three times, twice on private yachts and once on a merchant steamer. Think of it—one steamer, one single ship flying the Stars and Stripes passing the Suez canal in a year! It is because of that condition of things, because it means so much more than is apparent upon the surface of it, that every one interested in the great commerce of this country, that every one who has the foresight to see opportunities for the development of the commerce of this country has been long considering some method or means by which we might establish our merchant marine again upon the high seas. Now, that bill proposes doing just what every other nation in Europe is doing today, and even the South American states. There isn't a country in Europe that has a piece of shore line large enough to make a harbor, but what gives subsidies to its shipping. Why? To encourage and build up the merchant marine of the countries, and to extend their commerce to foreign ports. We have arrived at a state in this country where we are manufacturing more than we consume, and for the first time in the history of the United States on the first day of August, 1898, the books of the treasury department showed that we had exported more of our manufactured goods than we had imported. Remember that I say, all our manufactured goods—not our cereals, such as wheat, corn, flour and things of that kind, but goods that are manufactured by working people in the mills and factories of this country. That was the turning point in the commercial history of this country, and right along in that connection, as a reason for the Spanish war, the great markets of the east seem to have been opened to us, almost providentially, I might say, and the very flag that flies over Manila today stands there and will stand there as a protection to that commerce and the American ships that go there beyond the seas. When we produce more than we consume, what is the natural consequence? We must either find a market for the surplus product or we must cut down the production. Under the benefits of our splendid tariff law our trade has gone forward with a bound; confidence has been restored and business has resumed its normal condition and everybody feels safe in operating in the future, and that is just what "confidence" means. Under these conditions there is nothing under the heavens to prevent our country from taking the front rank in front of the front rank of the vast markets of the Orient. Why we are going to build the Nicaragua canal, and we are going to have shipping interests through there, yea, all over the world and don't you forget it; and we are going to have an increase in our navy to protect that canal and protect our commerce.—From a Speech in the Ohio Campaign.

SUBMARINE BOATS ABROAD.

Claims regarding the success of the Holland submarine boat, chronicled elsewhere in this issue, lend interest to the subject of submarine boats abroad. It is from the repeated failures of different types of submarine boats constructed in Europe that the sentiment hostile to submarine craft of all kinds, now so prevalent among British engineers particularly, has eminated. France has been the one European nation to keep steadily pegging away at the submarine boat idea despite frequent and numerous failures. The events of the past year or two demonstrate this conclusively. It was not so very long ago that there was an immense outburst of enthusiasm over the Gustave Zede, but later investigations proved that the range of action of the vessel was limited in the extreme. The French authorities got some consolation, however, out of the fact that the Zede had at least demonstrated the practicability of the submarine boat. After the Goubet boat, to which they next turned their attention, had been proven thoroughly impracticable, they pinned their faith to the Morse. Now that more complete trials of the Morse have been made, it is found that her range of action is quite as restricted as that of the Zede. The next submarine vessel with which experiments will be made is the Narvel, which was launched a few weeks ago at Cherbourg. The displacement of this latter vessel is 160 tons and she is fitted with a Forest oil engine, which not only drives the propeller when the boat is either navigating at the surface or with only her lookout and chimney exposed but also operates a dynamo for charging batteries and accumulators, these being utilized to propel the boat when she is entirely submerged and the chimney unshipped. Sailing at the surface at 12 knots the Narvel promises a range of action of 252 miles and at 8 knots the range will be 624 miles. When submerged the accumulators will propel the boat 25 miles at 8 knots and 75 miles at 5 knots. The Narvel is equipped with four torpedo tubes and carries two officers and nine men. The fault found with the Gustave Zede and the Morse is that their usefulness would be restricted to harbor defense service. Now that the French have devised a torpedo boat that can be swung to the davits of a man of war, possibly they will employ this method of remedying the short radius defect in their submarine craft.

It is said that one of the two large Atlantic steamers which the Wm. Cramp & Sons Co. is to build for the International Navigation Co. may possibly be christened Pittsburg. Work on the vessels will be started as soon as the land recently acquired from the Lehigh Valley company can be put into such shape that keels may be laid.

BRITISH TRANSPORT FLEET.

The present war in South Africa is interesting to persons in naval and shipping circles, in that it has afforded an opportunity for proof by Great Britain of her ability to quickly assemble a vast fleet of transports. Never before in the history of the world has an attempt been made to transport so huge a military expedition to so remote a field of operations. For the task the British government has chartered a fleet numbering more than 150 vessels, representing in the aggregate 650,000 gross tons register. This tonnage is equal to the entire steam merchant navy of a nation like Norway, and is very much larger than the merchant navy of any other nation except the United States, France and Germany. The vessels which have been drawn from the ocean carrying trade for this war service, belong almost entirely to the great lines, the British India, the Cunard, the Peninsular & Oriental, the Orient, the Castle, the Allan, the Union, the White Star, the Anchor and the Dominion being well represented. All of the vessels are modern, most of them speedy, and the average tonnage is in the neighborhood of 5,000 tons.

The chartering of this immense transport fleet withdraws from trade fully one-twentieth of the total British merchant tonnage and very naturally freights have gone up. However, no considerable amount of inconvenience has been entailed, for the places of the liners chartered have been taken by general traders. This one-twentieth of the British mercantile fleet is not referred to as a very large item and yet it represents a very large tonnage. What is meant by 650,000 tons is perhaps better conveyed when it is stated that were the German government to mobilize such a fleet, more than a fourth of the entire tonnage of the nation would be required. France would require one-half her tonnage and the United States about one-sixth, even with our lake tonnage included. The British government has already appropriated $17,500,000 for the conduct of the transport service during the present conflict.

CANADA'S 14-FOOT WATERWAY TO THE SEA.

A prominent vessel owner who was in Montreal a short time ago when members of the United States Board of Engineers on Deep Waterways inspected the St. Lawrence canals says that members of the board with whom he talked were certainly greatly impressed with the new St. Lawrence canals. "There will be no difficulty whatever," he says, "in having the entire system ready for use at the opening of navigation next spring, and Canada will then have in reality a 14-foot waterway through from the great lakes to the Atlantic seaboard with locks sufficiently large to pass vessels of about 265 feet length carrying nearly 3,000 tons of cargo. The Soulanges and Galops canals are completed down to finishing touches—so much so that the steamer which the Montreal Harbor Commission courteously placed at the service of the United States engineers was locked through the new canals. Like all large enterprises the completion of the contracts by no means implies that the works are in shape for commercial use, but having now filled the canal prism with water the engineers in charge of the work can remedy any slight defects of the gates and machinery and finish the revetment of banks where not yet done. There will be no delay on this score. The Canadians are certainly entitled to a great deal of credit for the large amount of first-class work which has been done on this improvement of the St. Lawrence canal system during the last few years."

A NEW SHIP BUILDING PLANT.

The submission by Townsend & Downey of Brooklyn, N. Y., a practically unknown ship building firm, of the lowest bid for the construction of two of the cruisers of the Denver class has naturally aroused considerable interest in ship building circles in the future plans of the firm in question. Wallace Downey, a member of the firm, denies emphatically the report recently circulated to the effect that some of the Cramps are interested in the new plant. He furthermore states that the new ship yard is now being constructed at Shooter's island in the Kills, about 400 yards from Mariner's Harbor, Staten island, and that the project will go forward whether the company receives the contract for any of the vessels in the present naval program or not. Between 300 and 400 men are now employed on the island. The machine shop has been completed, the blacksmith shop is well under way. Morris & Cummings of New York City are executing a big contract for dredging for the firm, and A. I. Crandall & Sons of Boston are constructing for them a marine railway of 4,000 tons capacity. Shooter's island is about five acres in extent. A pier 640 feet in length extends from the eastern end. This will be lengthened 400 feet and another pier 890 feet in length constructed. Between the piers two dry docks will be constructed. The firm claims that it will expend $350,000 in improvements. The island has a water front nearly two miles in extent with plenty of deep water.

It is probable that the Falls Hollow Staybolt Co. will sell about 100 tons of safety hollow staybolt iron to the American Ship Building Co. (great lakes consolidation) for the very large number of big Scotch boilers which they have under construction. This hollow staybolt iron is now being used as extensively among manufacturers of marine boilers as it has been used for a long time past by the locomotive builders. All the leading railroads of the country have been specifying it for locomotive boilers. It is stronger than the solid iron or steel and its great advantage is the hollow feature, which leaves no doubt as to broken bolts. As it is necessary according to government rules in marine service, to drill holes in the ends of all solid staybolts to a point within the boiler, it will readily be seen that the hollow bolts, although costing a little more than the solid article, may be cheaper in the end. This hollow staybolt iron will undoubtedly be used almost exclusively before long by manufacturers of marine boilers. It is now used by the W. & A. Fletcher Co., Pusey & Jones Co., Harlan & Hollingsworth Co. and in fact nearly all the ship builders of the east.

Martin S. Smith, partner of Russell A. Alger in the lumbering firm of Alger, Smith & Co., who died at his home in Detroit a few days ago, was very well known to vesselmen of the great lakes.

BIDS ON THE NEW CRUISERS.

Bids for the construction of tne six protected cruisers of the Denver class, authorized by congress at its last session, were opened at the navy department at noon Wednesday, Nov. 1. A great many ship builders and naval officers were present. The advertisement inviting bids specified that no bids would be considered which proposed to furnish vessels of less than 3,000 tons trial displacement or of less than 16½ knots speed on trial, or having a coal bunker capacity of less than 700 tons of coal. The congressional limit of cost was fixed at $1,141,800 each. Where bids in the following table are for two ships it will be understood of course that the price named is for each vessel. The bids were as follows:

Wm. R. Trigg Co., Richmond, dept. plans, 1 ship, 24 mos.	$1,027,000
Wm. R. Trigg Co., Richmond, (A) bldrs. plans, 1 ship, 24 mos.	1,041,000
Wm. R. Trigg Co., Richmond, (B) bldrs. plans, 18 kts., 1 ship, 24 mos.	1,073,000
Wm. R. Trigg Co., Richmond, (A) bldrs. plans, 16½ kts., 2 ships, 24 mos.	993,000
Wm. R. Trigg Co., Richmond, (B) bldrs. plans, 18 kts., 2 ships, 24 mos.	1,024,000
Wm. R. Trigg Co., Richmond, (C) bldrs. plans, 19 kts., 1 ship, 24 mos.	1,079,000
Wm. R. Trigg Co., Richmond, (C) bldrs. plans, 19 kts., 2 ships, 24 mos.	1,039,000
Moran Bros. Co., Seattle, dept. plans, 1 ship, 30 mos.	1,122,000
Fore River Eng. Co., Weymouth, Mass., mdfd. dept. plans, 1 ship, 27 mos.	1,065,000
Fore River Eng. Co., Weymouth, Mass., mdfd. dept. plans, 2 ships, 25 to 27 mos.	1,020,000
Fore River Eng. Co., Weymouth, Mass., bldrs. plans, 18 kts. 1 ship, 27 mos.	1,065,000
Fore River Eng. Co., Weymouth, Mass., bldrs. plans, 18 kts. 2 ships, 25 to 27 mos.	1,020,000
Fore River Eng. Co., Weymouth, Mass., bldrs. plans, 18½ kts., 1 ship, 27 mos.	1,100,000
Fore River Eng. Co., Weymouth, Mass., bldrs. plans, 18½ kts., 2 ships, 25 to 27 mos.	1,060,800
Burlee, D. D. Co., Pt. Richmond, dept. plans, 1 ship, 30 mos.	1,105,000
Neafie & Levy, Philadelphia, dept. plans, 17 kts., 1 ship, 30 mos.	1,080,000
Neafie & Levy, Philadelphia, dept. plans, 17 kts., 2 ships, 30 mos.	1,050,000
Townsend & Downey, New York, bldrs. plans, 17½ kts., 1 ship, 21 mos.	1,059,500
Townsend & Downey, New York, bldrs. plans, 17½ kts., 2 ships, 21 and 27 mos.	1,055,000
Townsend & Downey, New York, dept. plans, 1 ship, 21 mos.	954,500
Townsend & Downey, New York, dept. plans, 2 ships, 21 and 27 mos.	950,000
Columbian Iron Works, Baltimore, dept. plans, 1 ship, 30 mos.	1,116,000
Union Iron Works, Bath, dept. plans, 1 ship, 30 mos.	1,041,900
Bath Iron Works, Bath, dept. plans, 1 ship, 30 mos.	1,041,650
Lewis Nixon, Elizabeth, N. J., dept. plans, 1 ship, 30 mos.	1,039,966

From present appearances, seeing that the department is very much pleased with its own plans, and as the attitude at Washington is to spread the work around the country and give each firm but one ship to build, it is thought the contracts will go to the following firms:

Wm. R. Trigg Co., 1 boat at $1,027,000, dept. plans, 24 mos.
Lewis Nixon, 1 boat at $1,039,966, dept. plans, 30 mos.
Bath Iron Works, 1 boat at $1,041,650, dept. plans, 30 mos.
Union Iron Works, 1 boat at $1,041,900, dept. plans, 30 mos.
Neafy & Levy, 2 boats at $1,050,000 each, dept. plans, 30 mos.

Or Townsend & Downey or the Fore River Engine Co. may be awarded a boat and Neafy & Levy given but one at $1,080,000. The Fore River company is a strong organization, well equipped, and will undoubtedly insist upon its rights in the matter. The firm of Townsend & Downey has no facilities for naval work. A protest has been filed at Washington against the acceptance of their bid and this matter is now being investigated by government officials. The firm of Townsend & Downey is composed of James A. Townsend and Wallace Downey. Since 1885 it has had a ship repair yard at the long dock in Erie Basin, New York, but it has no facilities there for the building of cruisers. Persons connected with the yard say that the firm has a ship yard in course of construction at Shorter's island in the Kills opposite Newark Bay which will have ample facilities for the work. Mr. Downey says they expect to get a contract and that if they do they will be prepared to do the work in the time agreed upon. He declares emphatically that they are not depending upon any pull, political or otherwise, and that if an award is made to them it will be solely upon the merit of their bids. The Cramps, he said, are in no way interested in their bid, nor would they have anything to do with the building of the vessels if the firm got a contract. He says the yard at Shorter's island is not ready for ship building operations at the present time, but the firm is ready to expend $350,000 at once to put it in readiness. A certified check for $50,000, he said, accompanied their bid.

ENLARGED CANADIAN DRY DOCK.

Dominion officials have for some time past had under consideration proposals for the extension of the Lorne graving dock at Levis, opposite the city of Quebec, and it is now practically settled that the contract will go to Thomas Power of Levis, the lowest bidder. The departmental estimate of the cost of the work is $117,000. The job will be a difficult one inasmuch as it is nearly all rock excavation. It is proposed to enlarge the dock from its present length of 445 feet to 600 feet, which will provide room for any vessel entering the St. Lawrence river. The cost of the dock in its present state was $910,000. The enlarged dock will be the largest in the Dominion, the Esquimalt dock being 480 feet in length and Atlantic dock at Halifax 595 feet in length.

TWENTY-FIVE MILLION TON MARK.

UNUSUALLY BAD WEATHER WILL ALONE PREVENT THAT FIGURE BEING REACHED IN THE COMMERCE OF LAKE SUPERIOR DURING THE PRESENT SEASON.

With freight moving through the canals of the St. Mary's river at the rate of more than 3,500,000 tons a month, it is now quite certain that the total shipments to and from Lake Superior this season will reach the twenty-five million ton mark, or nearly four million tons in excess of any previous year. The net ton (2,000 pounds) is used in these statistics. The canal reports to Nov. 1 already show a record in excess of the total figures of any previous year. On the first of the present month the freight movement aggregated 21,444,754 tons, against 21,234,664 tons for the full season of 1898.

Bituminous coal shipments are gradually working up to the figures of 1898, but it is well known, of course, that the coal requirements of the northwest will be largely in excess of any previous year. The total movement of soft coal to Nov. 1 was 2,633,055 tons, compared with 2,850,376 tons on the same date a year ago. The principal gains are, of course, in wheat and iron ore. Shipments of wheat through the canals to Nov. 1 foot up 42,988,890 bushels, against 36,505,277 bushels on Nov. 1, 1898, and the iron ore total to the first of the month is 13,307,099 net tons, compared with 10,834,454 tons a year ago. A full summary of the traffic of both canals will be found in the following tables:

	VESSEL PASSAGES.	REGISTERED TONS.	FREIGHT TONS.
To Nov. 1, 1899	17,488	18,852,309	21,444,754
To Nov. 1, 1898	15,775	16,426,472	18,509,048
To Nov. 1, 1897	15,355	15,788,994	15,629,382

MOVEMENT OF PRINCIPAL ITEMS OF FREIGHT TO AND FROM LAKE SUPERIOR.

ITEMS.	To Nov. 1, 1899.	To Nov. 1, 1898.	To Nov. 1, 1897.
Coal, anthracite, net tons	691,977	438,083	444,258
Coal, bituminous, net tons	2,633,055	2,850,376	1,752,283
Iron ore, net tons	13,307,099	10,834,454	9,879,341
Wheat, bushels	42,988,890	36,505,272	41,284,034
Flour, barrels	5,815,459	6,113,966	7,145,141

REPORT OF FREIGHT AND PASSENGER TRAFFIC TO AND FROM LAKE SUPERIOR, FROM OPENING OF NAVIGATION TO NOV. 1 OF EACH YEAR FOR THREE YEARS PAST.

EAST BOUND.

ITEMS.	Designation.	To Nov. 1, 1899.	To Nov. 1, 1898.	To Nov. 1, 1897.
Copper	Net tons	99,503	105,180	107,612
Grain, other than wheat	Bushels	24,198,127	21,227,335	16,259,878
Building stone	Net tons	30,342	4,670	6,249
Flour	Barrels	5,813,634	6,113,039	7,144,856
Iron ore	Net tons	13,307,099	10,834,454	9,879,341
Iron, pig	Net tons	20,676	32,267	11,047
Lumber	M. ft. b. m.	910,508	799,491	715,529
Silver ore	Net tons	.....	.....	5
Wheat	Bushels	42,988,890	36,505,272	41,284,034
Unclassified freight	Net tons	109,092	198,600	198,606
Passengers	Number	22,615	19,616	18,859

WEST BOUND.

Coal, anthracite	Net tons	691,977	438,034	444,258
Coal, bituminous	Net tons	2,633,055	2,850,376	1,752,283
Flour	Barrels	1,925	927	275
Grain	Bushels	41,500	26,105	15,100
Manufactured iron	Net tons	153,088	189,219	104,204
Salt	Barrels	281,164	229,681	210,397
Unclassified freight	Net tons	375,491	337,575	308,177
Passengers	Number	24,547	22,840	20,617

SUMMARY OF TOTAL FREIGHT MOVEMENT IN TONS.

	To Nov. 1, 1899.	To Nov. 1, 1898.	To Nov. 1, 1897.
West bound freight of all kinds, net tons	3,887,124	3,848,122	2,350,282
East bound freight of all kinds, net tons	17,557,630	14,660,926	13,279,100
	21,444,754	18,509 048	15,629,382

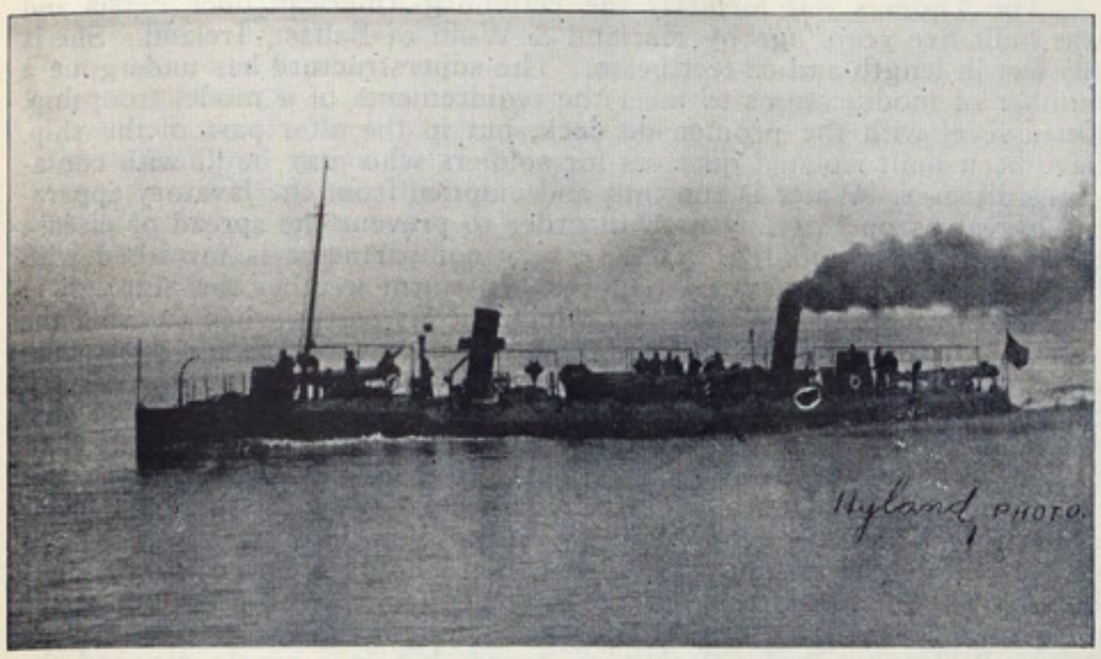
The total number of vessel passages to Nov. 1, 1899, was 17,488, and the registered tonnage 18,852 309.

Flint & Co. and Dearborn & Co., who intend to establish next year a service between New York, San Francisco and Honolulu, the ships for which are now under construction at the Roach Ship Yard, Chester, Pa., and by the Union Iron Works of San Francisco, announce that they will in the near future let contracts for two additional steamers. These latter vessels will each be of 10,000 tons capacity and will be for both freight and passenger service.

TWO SPEEDY TORPEDO BOATS.

CONTRACT REQUIREMENTS EXCEEDED IN THE INITIAL COMMISSIONS SECURED FROM THE UNITED STATES GOVERNMENT BY AN ENTERPRISING FIRM OF PACIFIC COAST SHIP BUILDERS.

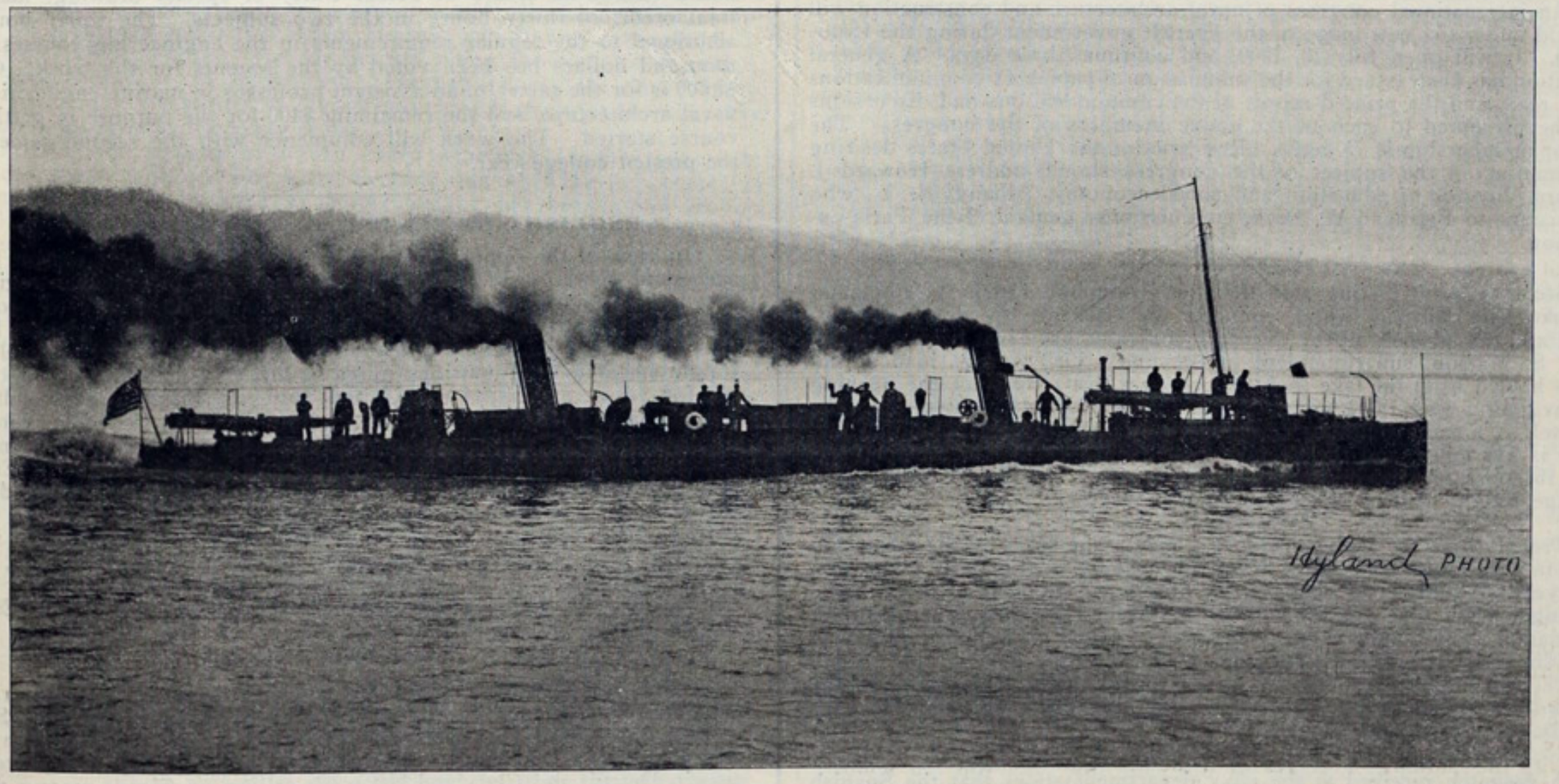
We present herewith reproductions of photographs of the torpedo boats Fox and Davis, recently completed by the Wolff & Zwicker Iron Works of Portland, Ore., for the United States government. Probably no ship building firm in the world has been more successful than this



TORPEDO BOAT FOX, BUILT BY WOLFF & ZWICKER.

concern in carrying out a first order of a naval kind. Despite the fact that the construction of these torpedo boats marked the first work undertaken by Wolff & Zwicker for the United States government, and that they entered upon the contract in the face of innumerable predictions of failure, the Pacific coast builders were particularly fortunate in securing more than the required speed from each boat, and that, too, on practically first trials. The Fox on her first trial exceeded the rate of speed required by eight-tenths of a knot, while the Davis on her second trial attained a speed nine-tenths of a knot in excess of contract.

In all main essentials these two torpedo boats are identical. Each is 146 feet in length over all, 14 feet beam, 5 feet draught when fully equipped with 6 tons of coal, and 110 tons displacement at the latter water line. The weight of the outside plating amidships and for about half the length of the vessel is 7½ pounds per square foot, reduced at the

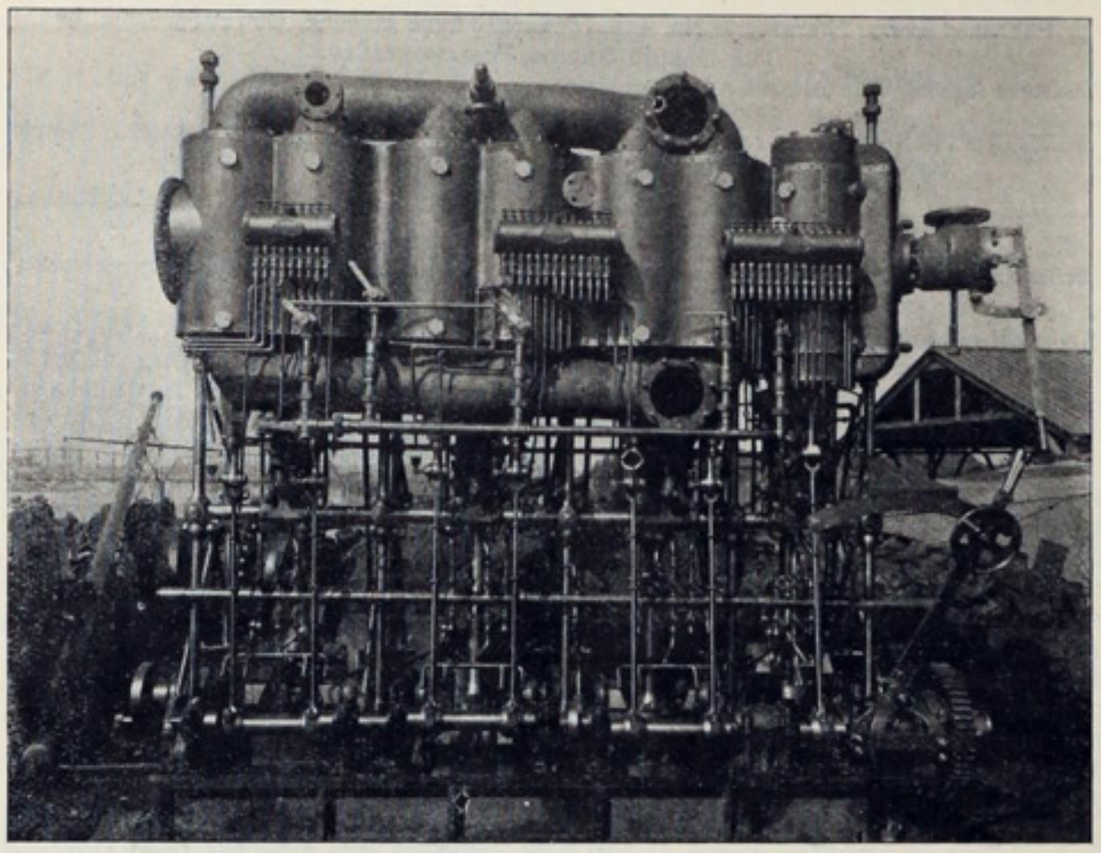


THE DAVIS, THE SPEEDY TORPEDO BOAT CONSTRUCTED BY THE WOLFF & ZWICKER IRON WORKS, PORTLAND, ORE.

end to 5 pounds. The plating is lap-jointed and double-riveted throughout. The conning towers will be constructed of plates weighing 7½ pounds per square foot.

Each boat is fitted with two vertical, four-cylinder, triple-expansion, direct-acting, surface-condensing engines, with cylinders of 12, 19 and 23 inches diameter and a stroke of 15 inches. The engines will develop 1,750 indicated horse power when making 395 revolutions. The condenser has a cooling surface of 1,400 square feet, measured on the outside of the tubes, and one single acting independent air pump is fitted to each engine. The propellers are of manganese bronze. Steam is supplied from two water tube boilers capable of developing 1,800 horse power under forced draft. The working pressure is 250 pounds per square inch, and the grate surface is 45 square feet on each boiler.

Particular attention was given during the construction of the vessel to the subject of ventilation which is afforded by means of cowls, so arranged as to form downcasts and outlets. The downcasts have been arranged as far as possible at the forward ends of the compartments which they supply with fresh air. The distilling apparatus on each boat



ONE OF THE ENGINES OF THE DAVIS.

has a capacity of 900 gallons in 24 hours. Each fire room is fitted with a blower of approved pattern, the blower engines being designed for a working pressure of 150 pounds.

TRIAL OF THE KENTUCKY.

The battleship Kentucky, sister vessel of the Kearsarge, which gave a very creditable account of herself during an official trial a short time ago, was given a builders' trial a few days since and despite the influence of a fierce northeast gale, which had been blowing steadily for 36 hours, acquitted herself in a manner that leaves no doubt of her capabilities. Of course no test for speed was made and the revolutions averaged only 75 to 80 during the greater part of the run, thereby giving the vessel a speed of from 12 to 13 knots. A thorough test of the steering apparatus was made and of the speed in turning. The Kentucky can be steered by telemotor, wire rope or hand gear. Thorough tests of the first two methods gave the greatest satisfaction. The hand gear was not tried because of the lateness of the hour after the conclusion of the anchor tests. Despite the foul condition of her bottom, the Kentucky, when forced draft was applied, ran into a heavy sea at as high as 109 revolutions on an average for fifteen minutes, a speed of 16 knots being attained. The steam pressure ran up to 170 pounds. This showing is all the more remarkable in view of the fact that while under forced draft the ship was running in shallow water. The maximum pitch of the vessel was 3 degrees and the maximum roll 18 degrees to starboard and 16 degrees to port. The Kentucky will leave for her official trial off Cape Ann about Nov. 14.

MARINE REVIEW

Devoted to the Merchant Marine, the Navy, Ship Building, and Kindred Interests.

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Chiefs of the bureaus of equipment, steam engineering, and construction and repair have submitted to Secretary of the Navy Long reports dealing with the proposition to consolidate the three bureaus in question. Rear Admirals Melville and Bradford, chiefs of the bureaus of engineering and equipment, respectively, oppose the idea. Even the recommendation of Rear Admiral Hichborn of the construction bureau is far more conservative than had been anticipated. He recommends that the duties of the three bureaus be adjusted so as to facilitate the business of ship design and construction. With this end in view, he requests that the mechanical work which has been carried on under the bureau of equipment be divided between the bureau of steam engineering and the bureau of construction and repair. It is understood that he favors the plan of transferring the purchase of coal to the bureaus of steam engineering and of supplies and accounts, and that he asks that electric appliances be placed under the bureau of construction and repair. This latter proposition is in the line of his theory that all matters pertaining to the lighting, heating, ventilating and drainage of ships of war pertain strictly to hull construction. Secretary Long will treat of the subject in his forthcoming annual report.

Aroused mainly by the growth of the American navy the German emperor is actively agitating the subject of an increase of the navy. His plan is to immediately double the navy by forming two new squadrons, each of which is to consist of ten ships of the line with cruisers and torpedo boats. One-fourth of this increase is to be made up temporarily of the present coast defense ironclads, which will be replaced later by modern ships of the line. According to the new naval program forty-eight large ships will be launched between 1901 and 1917. One will go into the water each year, in accordance with the provisions of the last naval bill; then three yearly until 1911, and of these eighteen will be additional ships and six will replace the antiquated vessels; then three and a half yearly until 1917, of which three will be additional ships and eighteen will replace the antiquated ones.

An international congress of naval architecture and construction will be held under the patronage of the French government during the exposition. It will open July 19, 1900, and continue three days. A general invitation has been issued for the submission of papers or communications to be read, and the printed report of the communications and discussions will be presented to each of the active members of the congress. The fee for membership is 75 cents. Residents of the United States desiring information on the subject of the congress should address Howard J. Rogers, director of education and social economy, Albany, N. Y., who is assistant to Ferinand W. Peck, commissioner general of the Paris exposition.

Some very interesting statistics concerning the Pittsburg, Bessemer & Lake Erie railroad, which connects the Carnegie ore docks at Conneaut and the furnaces of the Carnegie company, have just been compiled by J. S. Matson, superintendent of the line. The average load of full trains hauled from the lake to Pittsburg over this road since the opening of navigation was 1,644 net tons, or, including the weight of the cars themselves, a train weighing 2,137 tons behind the tender. The total distance is 145 miles, and the average time from terminal to terminal has been 15 hours, making the average running speed 10 miles per hour. The average freight charge was 4.1 mills per ton mile.

Preparations are being made on a very large scale by the steamship lines for the expected rush of travel on account of the Paris exposition next year. A number of important additions will be made to the Atlantic passenger fleet. One of these will be the former Hamburg-American liner Normannia, which after her service as an auxiliary cruiser in the Spanish fleet during the recent war, has been added to the fleet of the French line. The Hamburg line will have its capacity specially increased by the 23-knot Deutschland, and the Cunard line will have two handsome new vessels, the Ivereia and Saxonia.

A despatch received at the navy department states that the Spanish gunboat Arayat has been raised from the Pasig river where she was sunk by the Spaniards in May, 1898, to prevent her falling into the hands of Admiral Dewey. The wrecking operations were accomplished by a working force from the cruiser Baltimore, under the direction of Commander Moore of the gunboat Helena. The hull, boiler and machinery of the Arayat are in fair condition, but the wood work had been destroyed by the teredo worm. The vessel will be repaired.

What is known as a fathom meter is the latest marine invention to attract attention in the newspapers. The object of the device is to show at a glance the depth of water under a vessel's keel without the necessity of taking soundings. The invention is planned on the principle that the earth being a magnet and a smaller magnet being established in the instrument, by means of an electric current it is possible to have an indicator so adjusted as to register the exact distance between the greater and lesser magnets.

A HANDSOME TRANSPORT.

The Marine Review has already devoted considerable space, especially in a recent special naval edition, to vessels refitted for the transport service of the United States, but the transport Thomas, which has just been remodeled at the Cramp ship yard, Philadelphia, preparatory to a trip to Manila, has so many characteristics distinguished by a greater or less degree of novelty that further reference to the vessel may prove of value. It is generally conceded, indeed, that the Thomas is the most admirably appointed transport possessed by any nation. This vessel affords comfortable accommodation for almost 2,000 persons, including officers, soldiers, nurses and crew.

The Thomas was formerly the Hamburg-American liner Persia and was built five years ago by Harland & Wolff of Belfast, Ireland. She is 465 feet in length and 52 feet beam. The superstructure has undergone a number of modifications to meet the requirements of a model troopship. On a level with the promenade deck, but in the after part of the ship, have been built isolated quarters for soldiers who may be ill with contagious diseases. Water is run into and emptied from the lavatory apparatus by valves operated by foot, in order to prevent the spread of disease by contact with polluted water. Every compartment is furnished with hot and cold air as necessity requires. In warm weather the atmosphere is cooled by a spray of water, over which the air passes when entering the vessel. On the spar deck is a dining saloon and cabins for regimental officers. On the main deck are quarters for the ship's company, a carpenter shop, mess room, water cooling tanks, bakery, butcher shop, cold room and a hospital with accommodations for fifty-six patients. Connected with the latter are a diet kitchen, operating room, surgeon's and attendant's rooms, linen closet, etc. The capacity of the distilling apparatus is now 20,000 gallons per day. Four new blowers have been installed and double awnings provided. In the hold are seven ballast tanks holding 1,400 tons of fresh water. In the bakery all the kneading of the dough and the cooking for the men will be done by steam. Huge washing tubs will cleanse all the clothes on board ship in a single day and the automatic ironers and starching machines will also be able to handle the entire washing in a day.

MARINE ENGINEERING AT UNIVERSITY OF MICHIGAN.

A course in marine engineering and naval architecture has been established in the engineering department of the University of Michigan. The course is a graduate one requiring five years' residence at the university. The studies for the first three and one-half years are the same as those in the regular engineering courses. The special work begins the second semester of the fourth or senior year and continues through the fifth year. At the end of the fourth year the student receives the degree of bachelor of science in engineering, and at the end of the fifth year the degree of master of science in engineering.

The course of study as arranged includes eighteen hours of class room work in marine engineering and naval architecture and twelve hours (thirty-six hours of actual time) of special drawing, making a total credit of thirty hours in the two subjects. The thirty hours are additional to the regular requirements in the engineering courses. Two thousand dollars has been voted by the regents for the work. Of this $1,600 is for the salary of an assistant professor in marine engineering and naval architecture, and the remaining $400 for the purpose of getting the course started. The work will commence with the second semester of the present college year.

ENGLISH VESSELS FOR ST. LAWRENCE TRADE.

In view of the opportunities that will be offered next season for the successful operation of a large number of vessels of Canadian register in the trade from the upper lakes through the St. Lawrence to Montreal, Messrs C. W. Kellock & Co. of Liverpool and London, brokers for the sale and charter of shipping, are advertising for sale several steel screw freight steamers of dimensions suited to this trade. While it is not possible for vessel owners of the United States to bring foreign-built ships into the lake trade, on account of the duty on them, Canadians can make purchases of this kind for their coasting trade, and it is more than probable that quite a few steamers of canal size will be bought in England before the opening of another season. On account of the shallow draught of the canals (14 feet) and the flat-bottom, square shape of the vessels that are built for lake trade, the ships that could be bought for this service would be small carriers as compared with those of special design, but in view of Canada's limited ship building facilities for the present, it is reasonable to expect that some of the vessels offered for sale in England will be purchased by Canadian interests.

When the Fred Kelley, Warner and other wooden vessels were built for the ore trade by Bailey Bros. of Toledo in the early seventies, Samuel J. Tilden of presidential fame was interested in Lake Superior iron mines and in vessels of the lakes. He was represented by Capt. Shepherd, who was in Detroit and Cleveland last week calling on friends among the old vessel men. Capt. Shepherd has been in Texas for a number of years, where he owns an immense tract of land that is given up to cattle. His visit to Detroit and Cleveland was of a business kind, as he was following a large consignment of mules that were being sent into Pennsylvania for sale. He says he can send north through Michigan and Canada from Texas cattle bound for Pennsylvania at better rates than he can get by a direct route through St. Louis or Chicago. His home is in Marathon, Tex.

A. A. & B. W. Parker, vessel owners of Detroit, have bought the steam yacht Lilly and will make substantial improvements in her during the coming winter.

Capt. Wm. Wilkes, a retired vessel master of the great lakes, aged seventy-nine years, died at the home of his daughter in Cleveland, Monday.

NAVAL MATTERS REPORTED FROM WASHINGTON.

SECRETARY LONG'S REPORT—TO TEST ANOTHER DEVICE FOR COALING SHIPS AT SEA.

WASHINGTON BUREAU, MARINE REVIEW, 1345 PENNSYLVANIA AVENUE, WASHINGTON, D. C., NOVEMBER 8, 1899.

The annual report of Secretary Long will be submitted to the president within a very few days. The most important recommendation in the report is one that more warships be built and that the present armor question be settled so that work can continue on the vessels already authorized. The secretary's recommendations for naval increase will be limited to battleships and some small gun boats suitable for service in foreign waters. It is not believed he will urge provision for a large number of torpedo boats, owing to the delay in the completion of those now building, due to the inability of the firms to secure steel. The armor question is regarded by the department as by far the most important matter before it, for until some agreement is reached with the steel firms whereby the navy may purchase armor at a reasonable price, the building of all large vessels is practically prohibited. Two firms control the armor output and these will not yield a dollar to the government. The navy department has repeatedly urged congress to authorize a rate of payment which would be accepted by the firms and would be regarded as reasonable and equitable by the naval officials. In his report the secretary will present an urgent plea for immediate action on the armor question soon after congress assembles, as a separate measure, independent of the regular appropriation bill, in order that contracts may be awarded for three armored cruisers and the battleships.

If the government is to secure the best armor on the market for warships it must pay considerably more than for that last purchased for the Illinois and Alabama class. For years the American armor treated by the Harvey process was superior to any in the world. The government paid for some of this armor over $500 a ton and for the last contract $425. Congress for two sessions has decided that $350 and $400 a ton is all that the firms shall receive and they refuse to accept this. The new Krupp system of armor treatment is admitted now to be infinitely superior to the Harvey and produces a plate which Admiral O'Neil estimates is about 25 per cent superior to the Harvey plate. The increased resisting power of the Krupp armor enables battleships to carry lighter plates of less thickness and therefore decreases the weight, which can be used to increase coal supply and ordnance. The Krupp armor may be purchased for $500 a ton, a price which is not deemed exorbitant by naval officials.

The question of being able to coal vessels at sea is still occupying the minds of naval officials and a new contrivance for the purpose is to be tested shortly. Rear Admiral Bradford, chief of the naval bureau of equipment, who has charge of coaling stations and the purchase of all fuel consumed on warships, with that enterprise which has characterized all his work for the improvement of the service, notably resulting in the equipment of Tortugas and Pago Pago, Hawaii, and Cavite with automatic machinery of the highest type for quickly filling the bunkers of vessels, will have charge of the experiment. He has induced the navy department to lend him the battleship Massachusetts next week for an exhaustive test of a new system of coaling at sea.

The bunker capacity of almost every American warship, especially in those vessels designed before the Spanish war, when the importance of the matter had not received its proper weight, has been found far too small for the length of cruises demanded by the necessities of the case. The lack of coal drove Dewey's fleet from Mire bay to Manila and kept it there. It caused Sampson's fleet to retreat from San Juan, Porto Rico, and came near compelling Schley's flying squadron to abandon the blockade of Santiago. The experiment was tried during the war of taking coal from a collier fastened alongside, but this was impracticable except in smooth water and was fraught with too much danger to be attempted on the high seas. At one time it was proposed to send Watson's fleet with a number of colliers to menace the coast of Spain, but fortunately, perhaps, Spain agreed to peace at that moment.

Rear Admiral Bradford during the last month has fitted the collier Marcellus at New York with all the necessary apparatus to prove the merits and demerits in actual practice at sea of a system which is constantly seen ashore in public works of any magnitude, particularly in canal excavations and railway building, and which gives every promise of success. It is a device designed at the works of the Lidgerwood Mnfg. Co. and involves the employment of an overhead cable tramway for carrying coal between two ships. A tripod or shears is to be mounted on the after deck of the Massachusetts to carry a heavy wire cable, which is in turn attached to the foremast of the collier. By means of this cable, and perhaps one or more similar cables if the sea is high, the battleship will tow the collier, the object being, with the aid of drums of the towing machine kind, to keep the cable taut and to utilize the elevated one for carrying 400 bags of coal from the collier to the ship, the bags being hauled by smaller cables operated by a hoisting engine on the collier. The tramway cable will be about 100 fathoms long and its ends will be elevated about 20 feet above sea level. It is asserted by the designer of the contrivance that an average of 40 tons of coal an hour can be thus transferred, but it is understood that the navy is ready to adopt the apparatus and install it on many of the heavier ships if the rate of fifteen tons an hour is secured in bad weather and without reducing the speed of the ships too much; for it is regarded as of extreme importance that a method be secured by which a fast cruiser or battleship, if ordered to a distant point in an emergency, will have her bunkers replenished without the tedious delay of a stay in port.

Naval officials think that the apparatus will operate without a doubt when the battleship and collier are going along at a 5-knot gait, but the system will, of course, be of great value if the two vessels can continue on their course at the rate of 10 knots, and the Massachusetts and the Marcellus will make a trial at that rate. Here the question arises as to the extra amount of coal which a battleship will consume in towing the collier at reasonable speed. Up to the highest speed of which the collier is capable it is thought the battleship should use little extra coal in keeping the cable taut, but if an attempt is made to maintain excessive speed it is feared that the battleship would burn coal faster than the apparatus would carry it.

OFFICIAL SPEED TRIAL OF THE DAHLGREN.

The official speed trial of the United States first-class torpedo boat Dahlgren began Monday, Oct. 23, off the Maine coast. The trial was a very thorough, strict speed test on the standardized screw method, consisting of progressive trials, sea runs and turning trials. The naval trial board consisted of Capt. Wm. H. Emory, president, Commander Charles R. Roelker, Lieut. Commander Richard Henderson and Naval Constructor Washington L. Capps. Lieut. Commander Nauman, engineer inspector, and Lloyd Barkson, naval constructor stationed at the Bath Iron Works, were also on board. The trials were in charge of John S. Hyde, vice president of the Bath Iron Works, and Charles E. Hyde, consulting engineer. William A. Fairburn, chief hull draughtsman, Edward S. Hutchins, chief engine draughtsman, and Charles P. Weatherbee were the technical staff of the builders. Samuel P. Hinckley, engineer, and Capt. Blair of the Morse Tow Boat Co., had charge of the vessel and her machinery. The Dahlgren left the yard of her builders at 1 p. m., Monday, Oct. 23. She carried the full specified trial load of 20.29 tons plus coal and water which would be consumed in steaming to the measured base, and in making the low-power runs. There were thirty-four men on board, all told, and all were carefully weighed as they stepped on board. The measured-mile off Southport was reached at 2.15 p. m., and at 2.45 the progressive trial began with a double run, one with and one against the tide, at 240 revolutions. The mean speed was found to be 22 knots. The vessel made a long turn, and the revolutions were increased to 260 per minute, the corresponding speed in dead water proving to be 24 knots. The third double run resulted in a mean speed of 26.75 knots, with 283 revolutions, and the fourth double run gave a speed of 30 knots with 317 turns. As it was now rapidly growing dark, the fifth double run, called for at full speed, was omitted and the vessel returned to Bath.

The following day the Dahlgren left Bath at noon with the same personnel on board to complete the progressive trials. She made a few miles at 31 knots speed and steamed for about half an hour at speeds varying from 30 knots to 30½ knots per hour. A few runs and quick turns were made at full power, and at 4 p. m. she headed again for home. The trial board left Bath Tuesday night for the Charleston navy yard to inspect the Chesapeake in dry dock, so it was not until Friday, Oct. 27, that the official trial trip could be continued. In the meantime the wind had been kicking up a nasty sea, and on Friday the one hour's full power run at sea was attempted under very unfavorable conditions. The Dahlgren steamed for two hours, her average speed being 30.05 knots with 317.66 revolutions. At times she reached a speed of close on to 31 knots, notwithstanding many detrimental influences. The weather now is getting bad for high-speed runs with small, light boats at sea, and as the fall and winter advance the prospect for a fine smooth sea and fair day for a speedy run grow less probable, so the Bath Iron Works has decided to accept the speed run made under most unfavorable circumstances. Although the speed of 30.05 knots will go on record as the official speed of the Dahlgren, all the experts on board the vessel during the trial runs agree that she could have made much better speed in smooth water. The propeller never raced but the vessel shipped water and rolled at times quite badly. The Bath Iron Works is to be congratulated nevertheless in obtaining such phenomenal speed with a small vessel carrying a heavy trial load. The trials were very severe but the vessel passed through them without flinching and without any defects coming to light. The Dahlgren has never had an accident or break during any of her trial spins, and she has now successfully passed through her official trial, on the first attempt obtaining a trifle more than the designed speed of 30 knots. She has proved herself to be the fastest torpedo boat in the United States navy and she is without doubt the finest vessel of her type in the world.

NEW CANADIAN SHIP YARD ON THE LAKES.

A dispatch from Collingwood, Ont., gives details of plans for another Canadian ship yard, which will be equipped for the construction of all kinds of steel vessels, but more especially the type of 3,000-ton freight carrier for which a special demand is expected next year on account of the opening up of the St. Lawrence system of canals to the Atlantic seaboard. This is the enterprise with which Capt. Alex. McDougall of Duluth is to be connected. He has for a long time past made a special study of St. Lawrence navigation and the possibilities of trade through that route from the lakes to the Atlantic. The dispatch is as follows:

"Mr. J. J. Long, president of the Collingwood Dry Dock Co., announces that arrangements are about complete for establishing at Collingwood a modern ship building plant of very large proportions, at first capable of building four full canal-sized ships at once, or, if necessary, to build a 500-foot ship. The tools and entire equipment will be capable of turning out any steel ship that will be required in lake or canal trade. Arrangements for all this have been quietly going on for several months, and lately Capt. Alexander McDougall of Duluth, formerly general manager of the American Steel Barge Co., has decided to become a large stockholder and director in the company, and is at present helping the other directors to select machinery, superintendents, foremen and men to properly start the enterprise. It is expected to have the works in full operation in four or five months, so that the first steel ship can be launched by the middle of next summer. Some special arrangements have been made in regard to the ship plate and material which cannot be explained at present. The Collingwood dry dock and grounds will be turned over to the new company, who will enlarge and rebuild the present dry dock up to the full requirements of trade."

IN THE SHIP YARDS OF AMERICA.

LAUNCHES, TRIAL TRIPS, NEW ORDERS AND ALL MANNER OF NEWS FROM BUILDERS THROUGHOUT THE COUNTRY.

The recent successful launching of the United States torpedo boat Shubrick at Richmond, Va., a ceremony in which President McKinley, Secretary of the Navy Long and other notables participated, has served to again call attention to the plant which the William R. Trigg Co. has installed on the Potomac and the wonderful energy displayed by that company in surmounting seemingly the greatest of difficulties in a comparatively short space of time. The present site of the yard was leased Oct. 15, 1898, little more than a year ago, although the contracts for the construction of several torpedo boats and destroyers had been secured some months previous. Now the plant is one of the most complete as regards up-to-date machinery on the American continent. Heavy purchases of the latest kind of tools have been made and more are to follow. The Trigg Co. has secured the services of some of the best draughtsmen and department heads in the country and the present force of 550 men will be added to steadily.

The Wm. Cramp & Sons Co. of Philadelphia is certainly entitled to the congratulations of all its friends inside and outside the ship building industry for the achievement of launching the Russian cruiser Variag on time in the face of repeated declarations on the part of a body of turbulent strikers that the vessel could not be gotten ready to go into the water on the date appointed. The Variag has been fully described in previous issues of the Review. Suffice to say that in the construction of this vessel the Cramps have been obliged to face one of the most difficult problems ever presented in marine engineering. The plans call for a displacement of 6,500 tons and a speed of 23 knots, and this high speed must be maintained for twelve consecutive hours, which, it will readily be appreciated, is an undertaking vastly different to that of turning out a boat to meet the requirements of an ordinary four-hour test.

The Roach Ship Yard, Chester, Pa., is one of the few ship building works of the country that has been but little inconvenienced on account of scarcity of material. About fifteen carloads of material, on average, has arrived at the yard each day for several weeks past. The majority of the plates now in use at the Roach works come from mills at Harrisburg and Coatesville, while the bulk of the shapes are from the Pencoyd Iron Works, Philadelphia.

William Magee of East Boston, Mass., has secured a contract for the construction of a new steamer for the service of the Boston & Bangor Steamship Co. between the two ports named in the company's title. The W. & A. Fletcher Co. of Hoboken, N. J., will build the engines. The vessel will be of practically the same model as the City of Bangor, but will probably be 15 feet longer and of proportionately greater beam.

The Gas Engine & Power Co. and Charles L. Seabury & Co., Consolidated, of Morris Heights, New York City, include among their most recent work a handsome 60-foot yacht for Thomas G. Bennett, president of the Winchester Repeating Arms Co. of New Haven, Conn. The vessel is fitted with a gas engine and is capable of maintaining a speed of 12 miles per hour. She cost about $12,000.

The Pittsburg, Cincinnati & Louisville Transportation Co. of Pittsburg, Pa., has been incorporated with a capital stock of $150,000. The incorporators are A. L. Brahm and J. M. Phillips of Pittsburg, D. Scott of Zanesville, O., G. Wallace of O'Connellsville, O., C. Beckwith of Malta, O., and L. H. Brooks of Cincinnati.

The Sub Surface Torpedo Boat Co. has been incorporated at Trenton, N. J., with a capital of $1,000,000, to engage in the building of submarine and torpedo boats. The incorporators are William McAdoo, C. A. Burger, William Barbour, H. T. Toley, Charles D. Halsey and William Williams, all of Paterson, N. J.

Gardiner G. Deering has disposed of his ship yard at Bath, Me., to the Hyde Windlass Co., and has secured instead the ship yard at Bath, that was formerly owned by Chapman & Flint of New York and operated by John McDonald. Here Mr. Deering will in the spring lay the keel for a five-masted schooner.

Schofield's Sons of Macon, Ga., have just constructed a steel river steamer for the Dunnellon Phosphate Co. of Dunnellon, Fla. It is 85 feet in length and 20 feet beam but only weighs 21 tons. When afloat it will have a draught of but 14 inches, being designed for service on very shallow streams.

New England builders of wooden schooners are figuring on specifications sent out by McKay & Dix, ship brokers of New York City, for a double-decked, four-masted schooner of 1,100 tons, which, according to an agreement, must be launched not later than May of next year.

The tug building at Lewis Nixon's Crescent Ship Yard, Elizabethport, N. J., for the Staples Coal Co. will probably be completed early next month. This tug, which is to be called the Nemasket, is 116 feet in length, 24 feet beam and 14 feet depth.

A new river steamer to be called the City of Wheeling will be built during the coming winter by Mazingo Bros. at Clarington, W. Va. The vessel will be 165 feet in length by 34 feet beam. She will be completed about April 1, 1900.

President R. A. Smith of the New York & Cuba Steamship Co. and other New York capitalists are considering a project for the establishment of a new steamship line between New York and ports in Central and South America.

C. P. Carter & Co. of Belfast, Me., have launched the schooner Pendleton Brothers, a vessel of 858 gross tons. This is the 128th vessel launched by this firm, which was established in 1840

The board of estimate and apportionment of the city of Boston, Mass., a few days since authorized Superintendent of Streets Wells to construct and equip a new ferryboat.

A. D. Story of Essex, Mass., has contracted with M. Whalen & Sons of Gloucester, Mass., for the construction of a wooden schooner on the model of the Fredonia

The Columbia Packet Co. of Clinton, Iowa, has been incorporated. William J. Young, Jr., is president and Courtland H. Young secretary and treasurer.

It is said that the Delaware River Ship Building Co. of Chester, Pa., Roach yard, will, in the near future, install an air compressing plant at its works.

The steamer Alice May, building at the yard of Paul Le Roux at Albany, N. Y., for the Albany & Castleton Ferry Co. is practically completed.

The new tugboat Frank Richard, building for Capt. W. Pratt, has been launched at the ship yard of W. H. Baldwin, New Baltimore, N. Y.

DEMAND FOR AMERICAN MACHINERY.

Every week of late brings new evidence of the firm foothold that is being acquired in foreign markets by our manufacturers of tools and machinery of all kinds. Sales agents from various parts of the world—importers when they are at home—have been coming here in great numbers of late to give personal attention to purchases. Their object, of course, is to make arrangements for the purchase of much larger quantities of machinery than in the past. The Review told last week of the advances made by American ship building machinery in the orient. Now comes Charles Churchill of London with an almost exactly similar story, which, however, is far more significant since the trade in which he is the pioneer is the importation of tools and machinery into Great Britain, famous as the greatest ship building nation of the world.

Mr. Churchill, who has just arrived in this country has offices in London, Birmingham, Manchester, Newcastle-on-Tyne and Glasgow. During the past three years he has sent to this country orders for more than $3,000,000 worth of machine tools. He now has under order more than $500,000 worth of American tools. Mr. Churchill says that the English prejudice against everything American which existed a few years ago has now worn off almost entirely. He added: "If Great Britain wishes to retain her position in the world's trade she will have to look to America for improved labor-saving devices."

Among recent orders filled from this country was one for several radial drills, which were installed in the plant of John Brown & Sons, the large government armor plate manufacturers of Sheffield, England. The drills were made by the Bickford Drill & Tool Co. of Cincinnati. Armstrong, Whitworth & Co. and other large ship building and engineering firms of England are being supplied with boring mills made by the Bullard Machine Co. of Bridgeport, Conn. It is against the rule to put agents for foreign-made tools on the contractors' lists of the English admiralty, but scarcely a day passes now without one or more orders for American tools. Among goods which the British government itself has recently purchased are emery wheels manufactured by the Brown & Sharpe Manufacturing Co. of Providence, R. I., and micrometers from the works of L. L. Starrett & Co. of Athol, Mass.

Some of the United States consuls at foreign ports are doing valiant service in encouraging introduction of ship building machinery from the states. Mr. Louis H. Ayme, consul at Guadeloupe, writes that he has been asked for information regarding steam boilers, engines, accessories, etc., for the largest machine shop in the place, the plant being connected with the steamboat line of the island. The manager, he says, particularly desires information regarding portable steam boilers, mounted on wheels; marine engines for small steamers; marine boilers; steam and safety valves; lubricators; steam and vacuum gauges; ordinary steam pumps and centrifugal pumps. Mr. Ayme says he will be glad to receive catalogues, price and discount lists from manufacturers of the various articles enumerated.

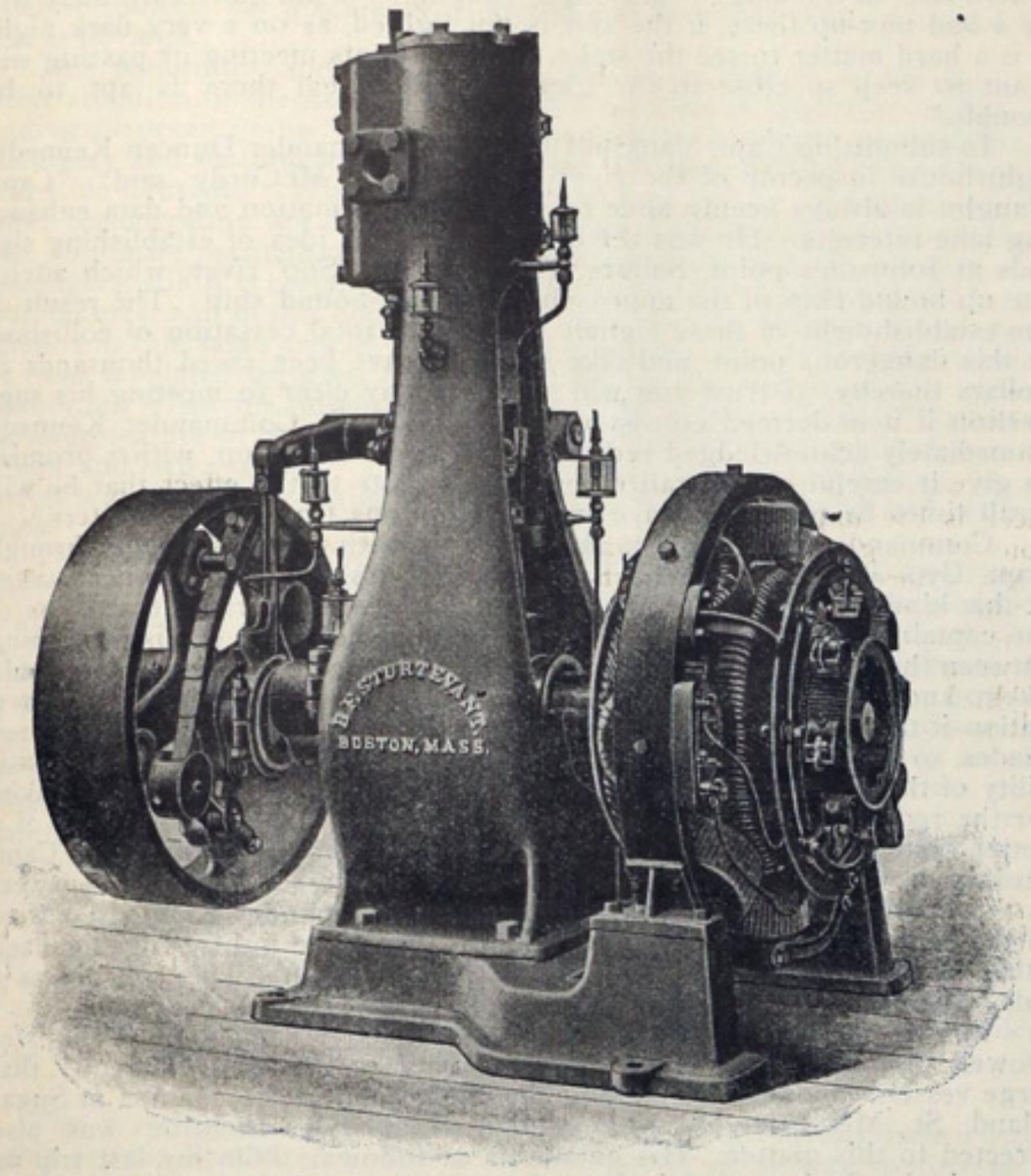
LAUNCH OF THE SAN JUAN.

The steamer San Juan, which the Harlan & Hollingsworth Co. of Wilmington, Del., recently launched for the New York & Porto Rico Steamship Co. of New York, is a sister ship to the Ponce, which was credited with a very successful maiden trip this month. The San Juan is designed to carry a very large amount of freight on small coal capacity and is of the following dimensions: Length over all, 335 feet; length between perpendiculars, 317 feet; length on water line, 322 feet; beam moulded, 42 feet; depth at centre to main deck, 19 feet 10 inches; depth to spar deck, 27 feet 8 inches; depth at side to spar deck, 26 feet 9½ inches; depth to main deck at side, moulded, 19 feet; draught, loaded, 19 feet; gross register, 3,503 tons; net, 2,819 tons. Her engines are direct tricompound, with inverted cylinders of 24, 38 and 62 inches diameter and 42 inches stroke. Steam is supplied by two Scotch boilers, 14 feet 6 inches in diameter and 11 feet long, fed by six furnaces of 48 inches diameter, and built to withstand a pressure of 180 pounds. She has six water tight bulkheads, four hatches, four winches, Hyde steam capstan, Hyde capstan aft, two steel masts, electric light plant for 250 electric lights, five-ton evaporator, five tanks of 8,000 gallons capacity, bunker capacity of 350 tons, carrying capacity of about 3,500 tons. Accommodations are provided for seventy-two first-class and twenty second-class passengers. The vessel is built for a sea speed of 12 knots. She is tastefully fitted out with hardwood and has every modern convenience.

The San Juan is the eighth ship launched by the Harlan & Hollingsworth Co. in the past year. This company now has in its yards the torpedo boat destroyer Stringham, which is undergoing a builder's trial. Although not speeded as yet, the Stringham has far exceeded all expectations in her trial runs. Two 29-knot torpedo boat destroyers for the United States navy, the Hull and Hopkins, will be completed sometime during next year. Two freight steamers for the New York & Baltimore transportation line are now in frame and will be launched before long. The steamship Grecian for the Boston & Philadelphia Steamboat Co. will probably be launched next month. A steamer for the Metropolitan Steamship Co. of New York is to be delivered in the early spring. There will be laid down in the place made vacant by the launch of the San Juan three tugs for the Pennsylvania Co. All this, together with much car work and five ships undergoing repairs in the dry dock and along the wharves, gives the yard a very busy appearance.

A COMPACT GENERATING SET.

In most cases generating sets are provided with outboard bearings for the armature shafts. In the type herewith illustrated, this extra bearing is done away with, and the armature is overhung upon the end of the engine shaft. In order to secure compactness, the generator is of the 8-pole type, the field ring being of wrought iron, cast steel or cast



iron, according to the size of the machine. The pole pieces of wrought iron are provided with cast iron shoes of such size and shape as to render the machine capable of extreme variation of load without sparking at brushes, or without shifting the adjustment. The field coils are wound in such a manner as to present the greatest amount of radiating surface, and the armature is built up of laminated steel discs, mounted on a cast iron spider, having a hub projection for the reception of the commutator. The commutator is of large diameter, and consists of pure-rolled or drop-forged segments, supported by a cast iron spider, and thoroughly insulated with mica and micanite.

The design of this machine is such that a very small amount of energy is dissipated at the brushes. The spider construction allows perfect ventilation on all sides, and consequently a cool commutator. Reaction brushes of fiber graphite are used. No shifting of brushes is required from no load to full load, and sparkless operation is maintained. The engine is cast in a single piece, is very compact, and all wearing parts are arranged for adjustment. The engine cylinder is lagged, reliable oil devices are provided for all bearings, and a delicate regulator, by its operation, maintains a practically constant speed. The valve of the engines is of the piston type, and therefore practically balanced. The crank discs are counterbalanced, and high speed is made possible. The governor wheel and the armature serve to assist materially in resisting any sudden variation of speed.

This set is one of a line of generating sets designed and built by the B. F. Sturtevant Co. of Boston, Mass. The smallest sets have a 4x4 engine, with an output of 3,000 watts, and a combined weight with the generator of 1,100 pounds. The largest size is a 7x7 engine, with an output of 10,000 watts, and a combined weight of 2,700 pounds. These engines are designed to operate at 90 pounds pressure. A line of sizes is also made suitable for operation at very low pressures. It is evident that this construction makes possible a minimum weight for a given output.

GRAIN AND COAL IN THE NORTHWEST.

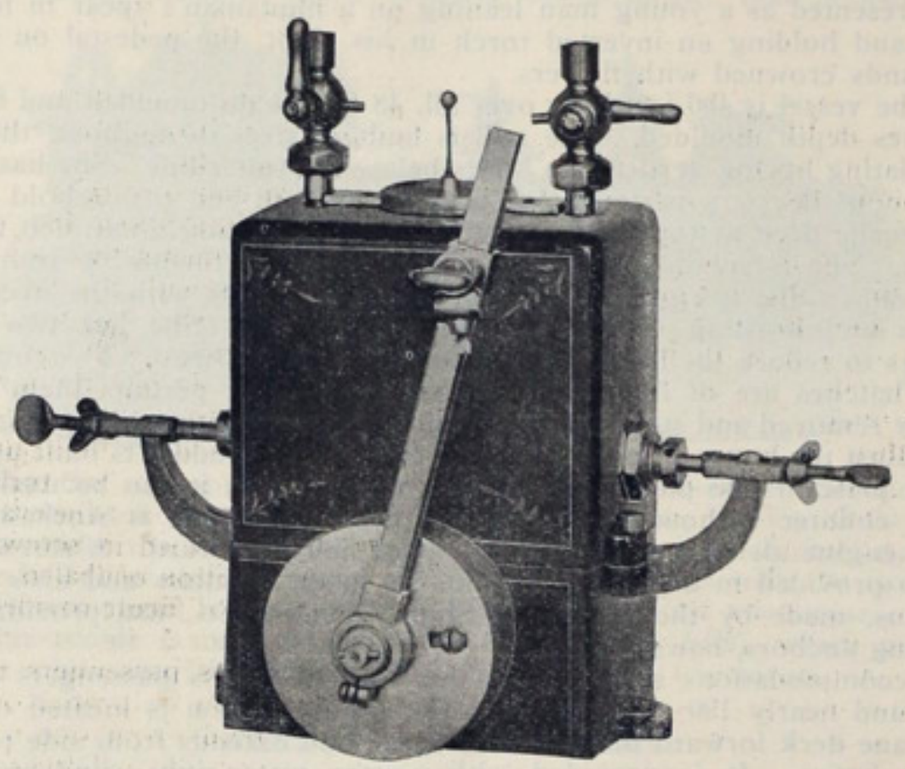
Duluth, Minn., Nov. 8.—Although the bottom has dropped out of the lake freight market on account of the prices at which grain is being withheld from sale, we still have a few large shippers who believe that an improved demand for wheat will spring up before the close of navigation. The elevators are certainly in position to give good dispatch to vessels, owing to the large accumulations of wheat and flax. Grain is still accumulating here. Up to a day or two ago, shippers of flax were offering 4½ cents for vessels, late shipment, and to hold in Buffalo all winter, but now there is nothing doing. Unless conditions change materially it is not probable that wheat shippers will require more tonnage for storage at Lake Erie terminals.

Railroad managers are especially anxious about their coal supplies, on account of the evidence of a great shortage. Probably the end of the season will see as much coal delivered here as was delivered in 1898, but in the spring of 1898 we had large supplies carried over, as against practically no surplus carried over last spring. It is the increased requirements, however, that will cause the great shortage. Some of the railroads will be hauling, all winter, grain destined for shipment to the seaboard. It is understood, for instance, that the Duluth, South Shore & Atlantic will be delivering very large quantities of grain during the winter to the Canadian Pacific at the Sault.

PHENIX OIL PUMP.

One of the economies of the engine room that has attracted considerable attention for years from shrewd managers is the question of a proper supply of oil. It is one of constant expense during the life of the plant and has therefore greater importance than would seem at first glance to attach to it.

The Phenix oil pump, an engraving of which we show herewith, is

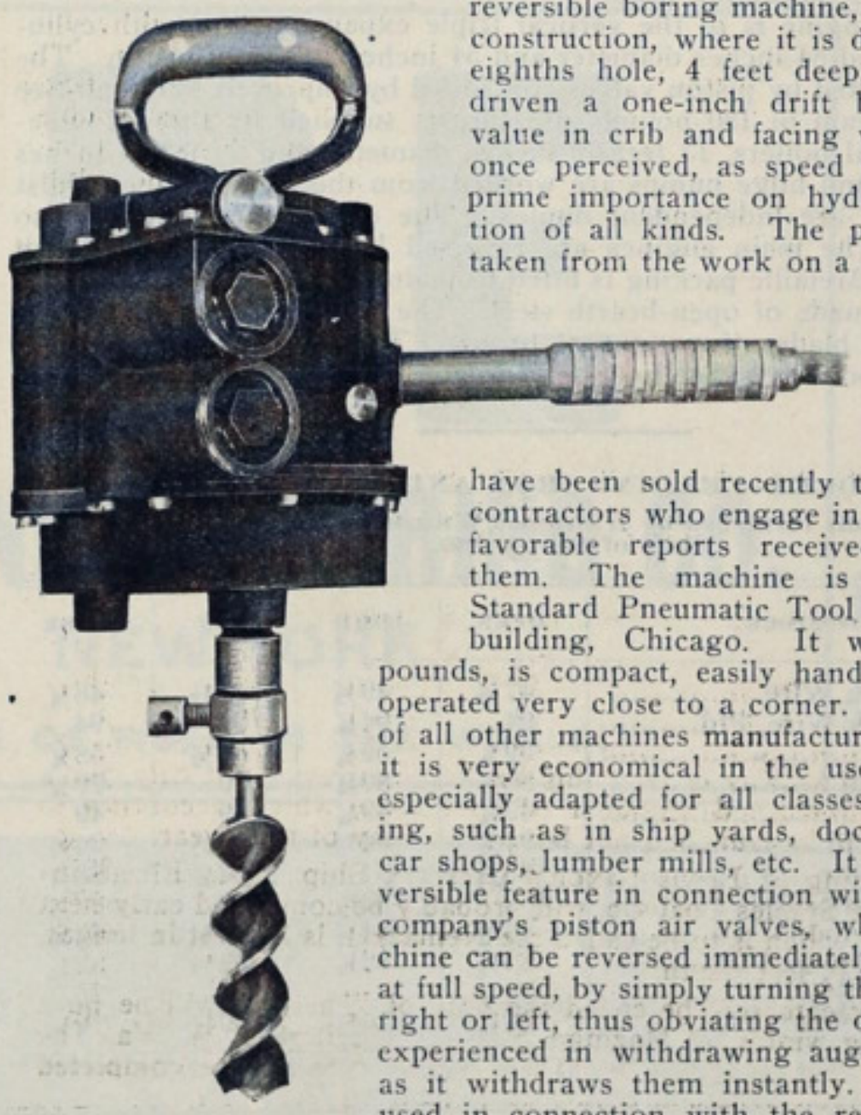


a device that feeds just enough oil to every joint and surface that needs lubrication on an engine or pump and does not feed when the machinery is not running. It feeds slowly at low speeds and increases the oil supply with the increase of speed. It costs nothing to run and the saving runs from 30 per cent upwards. The manufacturers guarantee it to save 50 per cent. It can be filled while running and is made in pint, quart, half-gallon and gallon sizes.

These pumps are in use by a great number of large concerns and are daily increasing in favor among railroads for locomotives and shop use, large manufacturers, on engines and pumps, city lighting and pumping stations, etc. Write the Phenix Metallic Packing Co., 177 La Salle street, Chicago, for illustrated circulars and list of users.

PNEUMATIC TOOLS IN DOCK WORK.

We show in this issue another of the many uses to which pneumatic tools have found their way. The view shows a "Little Giant" pneumatic, reversible boring machine, No. 5, on dock construction, where it is drilling a seven-eighths hole, 4 feet deep, into which is driven a one-inch drift bolt. Its great value in crib and facing work will be at once perceived, as speed is frequently of prime importance on hydraulic construction of all kinds. The photograph was taken from the work on a dock that is being constructed by Messrs. Hughes Bros. & Bangs at Buffalo, N. Y. These tools have been sold recently to a number of contractors who engage in dock work and favorable reports received from all of them. The machine is made by the Standard Pneumatic Tool Co., Marquette building, Chicago. It weighs only 12 pounds, is compact, easily handled and can be operated very close to a corner. As in the case of all other machines manufactured by this firm, it is very economical in the use of air, and is especially adapted for all classes of heavy boring, such as in ship yards, dock construction, car shops, lumber mills, etc. It possesses a reversible feature in connection with the Standard company's piston air valves, whereby the machine can be reversed immediately while running at full speed, by simply turning the handle to the right or left, thus obviating the difficulty usually experienced in withdrawing augers from holes, as it withdraws them instantly. No gears are used in connection with the reversible attachment. The Standard company has just issued a new catalogue which should be in the hands of every one interested in marine work. It may be had on application.



To describe the innumerable good qualities of any kind of machinery in an attractive way and in small space is a difficult task, but it seems to have been satisfactorily accomplished by the Kingsford Foundry & Machine Works of Oswego, N. Y., in a little pamphlet which they have just issued and which bears the title "Centrifugal Pumping Machinery." Features of special advantage claimed for this type of pump include self-oiling bearings, solid scrolls or shells, removable suction head, (which permits of examination of the interior of the pump without removal of the same from the base or bed) large shafts and pulleys and an improved stuffing-box that will remain tight under the most trying circumstances.

CROMWELL LINER COMUS.

The steamer Comus, to be launched today, Nov. 9, from the yard of the Newport News Ship Building & Dry Dock Co., is a steel passenger and freight steamer for the Cromwell Steamship Co. for service between New York and New Orleans. She has been built under the superintendence of Mr. Horace See of New York from plans and specifications prepared by him. She is named after Comus, the god of festivity, who is represented as a young man leaning on a huntsman's spear in his left hand and holding an inverted torch in his right, the pedestal on which he stands crowned with flowers.

The vessel is 406 feet long over all, 48 feet beam moulded and 33 feet 9 inches depth moulded. The hull is built of steel throughout, the outside plating having vertical lap joints below the water line. She has three continuous decks, a partial orlop deck at forward end of forehold and a promenade deck at top of main deck-house, extending about 180 feet in length. She is subdivided into water-tight compartments by transverse bulkheads. She is rigged with two steel pole masts with the necessary booms and hoisting engines for handling cargo. She has two cross hatches to reduce the lift in loading and unloading cargo. The covers of these hatches are of improved construction, which permits them to be rapidly removed and stowed away by the simple operation of folding them up against the house aft and on deck forward. The rudder is built up with center plate in one piece and stock in two, so that it can be unshipped below counter without disturbing the gear above. It is worked by a steam engine aft controlled from the pilot house forward. A screw gear is also provided in a pilot house aft. A steam windlass and also steam capstans, made by the American Ship Windlass Co., are provided for handling anchors, hawsers, etc.

Accommodations are provided for fifty first-class passengers amidships and nearly 190 steerage aft. The dining saloon is located on the hurricane deck forward of the boiler space and extends from side to side of the house. It is provided with square water-tight windows with ventilator at the top. The pantry and galley are aft of the saloon, between it and the boiler bulkhead. State rooms and ladies' toilet are located between the forward end of the saloon and forward end of the house. A stairway leads from the after end of the saloon to deck above into a lobby in the form of a cross with staterooms at ends opening into it. The general ton of finish is white and gold. First-class passenger accommodations are also located outside on saloon deck at the after end and ventilated by natural and mechanical means. The steerage accommodations are at the after end of the vessel, the bulk being in a house on deck and the remainder immediately below. Steam heat is furnished to all parts of the vessel, whilst the first-class state rooms are furnished with electric heaters, in order to have complete regulation of heat in them. The vessel is lighted throughout by electricity. A search light is placed in the crow's nest on the foremast. All running lights are connected to a Russell-See electrical indicator placed in the pilot house. Life boats, rafts, life preservers, etc., are fitted in accordance with the United States steamboat inspection laws.

The main engine is of the vertical triple expansion type with cylinders of 33, 52 and 84 inches diameter and 54 inches stroke of piston. The steam is distributed by piston valves controlled by improved Marshall-See valve gear. Steam of 180 pounds pressure is supplied by three double-ended cylindrical boilers, 13 feet 10 inches diameter and 20 feet 6 inches long. The air and bilge pumps are worked from the main engine, whilst the feed pumps are independent duplex. The circulating pump is also independent. The main engines are reversed by steam and controlled by a governor. Metallic packing is fitted to main and all auxiliary engines, The shafts are made of open-hearth steel. The propeller is built up with hub of steel and blades of manganese bronze. The ashes will be removed from each fireroom by a See hydro-pneumatic ash ejector.

VALUE OF STOCKS—LEADING IRON AND STEEL INDUSTRIALS.

Quotations furnished by HERBERT WRIGHT & Co., Cleveland, date of Nov. 8. 1899.

NAME OF STOCK.	OPEN	HIGH	LOW	CLOSE
American Steel & Wire.....	47½	49½	47⅜	48¼
American Steel & Wire, Pfd.....	94	94¼	94	94
Federal Steel	59¼	59¾	57½	58¼
Federal Steel, Pfd.....	80¾	80¾	79	79¼
National Steel	49¾	49¾	49	49
National Steel, Pfd.....	94½	94⅝	94½	94½
American Tin Plate	33⅝	34	33¼	33¼
American Tin Plate, Pfd.....	82	82½	82	82½
American Steel Hoop.....	43½	44½	43½	43½
American Steel Hoop, Pfd.....	82⅛	82½	82⅛	82½
Republic Iron & Steel	26	.....	.....	26
Republic Iron & Steel, Pfd.....	69¾	70½	69¾	70⅛

OF INTEREST TO EVERY SHIPMASTER ON THE GREAT LAKES.

A short time ago Capt. J. F. Vaughn of the steamer Northern Queen, wrote to George L. McCurdy of insurance interests in Chicago, suggesting that he take up with the proper authorities the matter of having a gas buoy placed at the lower spit extending down the St. Clair river from Stag island. "A buoy is certainly needed at that point if it is needed anywhere else on the lakes," said Capt. Vaughn. "I am quite sure there will be a bad mix-up there, if the spit is not lighted, as on a very dark night it is a hard matter to see the stake, and two boats meeting or passing will want to keep so close to the Canadian shore that there is apt to be trouble."

In submitting Capt. Vaughn's letter to Commander Duncan Kennedy, light-house inspector of the river district, Mr. McCurdy said: "Capt. Vaughn is always keenly alive to securing information and data enhancing lake interests. He was the originator of the idea of establishing signals at Johnson's point, Sailors' Encampment, 'Soo' river, which advise the up-bound ship of the approach of a down-bound ship. The result of the establishment of these signals has been a total cessation of collisions at this dangerous point, and lake interests have been saved thousands of dollars thereby. I trust you will see your way clear to meeting his suggestion if it is deemed consistent and desirable." Commander Kennedy immediately acknowledged receipt of this communication, with a promise to give it careful consideration and with a note to the effect that he will at all times be glad to receive such suggestions from vessel masters.

Commander Kennedy has also taken up with the vessel men, through Capt. Geo. P. McKay of the Lake Carriers' Association, another matter of this kind. He wrote Capt. McKay that he was informed that some of the captains navigating the lakes complain of difficulty of distinguishing between the lights of the Lake St. Clair 20-foot dredged channel. He would like to know if this complaint is general, and if it would be an aid to navigation if the lights on the easterly side of the cut were provided with red shades, so as to make the distinction more evident. As there was a possibility of the red shades causing confusion on the score of being mistaken for the red lights of vessels on the wrong side, and as the matter of a better system of lights in this cut was of considerable importance, Capt. McKay sent out letters of inquiry to some 200 vessel masters. Answers to these letters are now being submitted to Commander Kennedy. Most of the captains seem to be of the opinion that more lights, opposite each other in all cases, would be a decided improvement. They do not as a rule, object to the red shades if it is thought advisable to use them.

The last issue of the Review contained a letter from Capt. Robt. McDowell of the steamer Kearsarge, referring to the great difficulty that large vessels encounter in making the sharp turn in the channel at Sugar island, St. Mary's river. Commander Kennedy's attention was also directed to this matter. His answer is as follows: "On my last trip up through the Sault river I had careful soundings taken at this point, and found that the water at the buoy had shoaled out 18 feet 6 inches, with a ridge running some distance north and south with 19 feet of water on it. All around this was 20 feet of water. I informed Col. Lydecker, United States engineer, of these facts, and asked if it would be possible to have the shoal dredged away so we could set the buoys farther back. Col. Lydecker has informed me that this work is now in progress, and very soon we hope to have this shoal taken out and the gas buoy set some distance back, so as to widen the channel and ease up this turn."

On and after Nov. 6, 1899, the Nickel Plate road will run its dining car on train No. 3 between Buffalo and Bellevue instead of between Conneaut and Fostoria as heretofore. 164, Nov. 30

SHAFT FAILURES.

Syren and Shipping of London, date of Oct. 11, has an article under the head of "Shaft Failures" with tables showing the accidents to shafts during the months of July, August and September, in which they say: "We have ever associated the painful frequency of disasters of this type with the alleged necessary custom of sending ships to sea without a sufficiency of ballast. That an underladen steamer wallowing across the Atlantic subjects her machinery to strains which it was never intended to bear is obvious."

This paragraph, and indeed almost the entire article, is intended to direct attention to the need of some definite action in regard to sufficient loading of ocean-going vessels, to prevent such accidents to propelling machinery and shafting, the tables referred to being entitled "Our Underload Line Crusade." While the question of load line is, of course, one of grave consideration not only for the safety of shafting and machinery, but also, and more particularly, on account of the safety of hulls, cargoes and passengers, still it is certainly not the only nor even the principal cause for shaft failures, and in this connection attention may be directed to two paragraphs in this same article, namely, "it is worthy of note that the vessels we have tabulated incurred disaster not during the storms of the winter season, but when the ocean is on its very best behavior"; and "the most alarming feature of the table, however, is the preponderance (in disaster) of new and large vessels. This is a disquieting condition of things, for it carries with it a discreditable reflection upon those who build and engine ships."

This last suggestion is very probably one of even more importance than that of load-line, as far as the question of shaft and machinery breakdowns is concerned, and it is therefore pleasing to note that in the tables published by Syren and Shipping, showing over fifty shaft failures in three months, there are only three American-built boats, and the largest of these is of only 196 gross register tons, and they are all old timers. The question is one of grave importance, however, and especially so on the great lakes, where the tendency is to build the largest of carriers, and where, during the one month of August of this year there were no less than five shaft breakdowns, but we are glad to note the evident consideration which is being given the matter of specifying the very best of materials and workmanship.

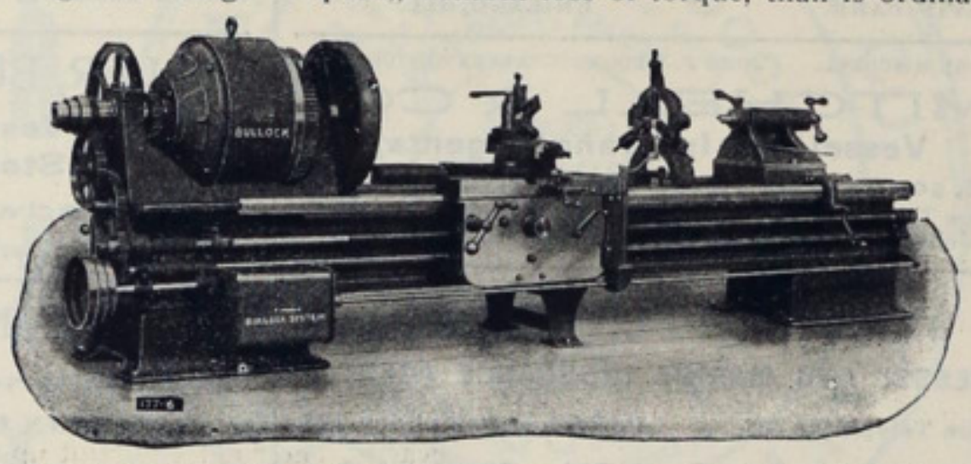
In the matter of shafts the Bessemer Steamship Co. has taken the lead, and the last three steamers built for them have had hollow forged oil tempered shafts, made under the hydraulic press, the very highest type of forging practice. Two other vessels for the same company, now under way, will be similarly equipped.

The Westinghouse companies of Pittsburg have recently issued two highly artistic illustrated booklets on the subject of railway motors and the Westinghouse electro-pneumatic system for controlling railway and other motors. In view of the rapid extension of electric traction for railways, the information contained in each of these publications cannot fail to prove highly instructive to all persons interested.

ANOTHER BULLOCK TYPE OF MOTOR.

The illustration shows a 28-inch swing screw cutting engine lathe driven by a Bullock type "N" motor. As will be seen, the motor is placed directly on the spindle in the head stock, taking the place of the cone pulleys. The armature spider is built directly upon the hollow spindle of the lathe.

By means of a new system of variable speed control, the motor is given a greater range of speed,, without loss of torque, than is ordinarily



given by the cone pulley, having sixteen speeds in either direction including the back gear. The controller is placed upon the leg of the lathe directly under the head stock, and is operated by a splined shaft running along the bed of the lathe, and a handle which travels with the carriage. The slowest speed is sixty and the highest about 250 revolutions.

This motor is fully described in bulletin No. 5,035, which may be had by addressing the Bullock Electric Mfg. Co., Cincinnati, O.

KENNEY FLUSHOMETERS.

The following letter received by the Kenney Co., New York City, speaks for itself, and should be of interest to readers of the Review:

Gentlemen:—In looking over a new ship, the steamer Angeline, which we have just received from the Detroit Ship Building Co., I was much pleased to note what seemed to be a very excellent steamboat closet, called the flushometer. I would like very much if you would send me a catalogue with prices of these closets. Every now and then there are some of the closets on our vessels giving way, and this one seems to be of some value—the first one, in fact, I ever saw that was.

THE CLEVELAND-CLIFFS IRON CO.,
Cleveland, Oct. 21, 1899. (Signed) J. H. Sheadle, Secy.

The Nickel Plate road offers one and one-third fare for the round trip Nov. 29 and 30, good returning until Dec. 1, inclusive, account Thanksgiving day. Tickets available within a radius of 150 miles. Inquire agents. 167, Nov. 30

VESSEL AND INSURANCE AGENTS.

C. W. ELPHICKE & CO.
General Insurance Agents,
Room 10, No. 6 Sherman St.,
C. W. ELPHICKE.
CALVIN CARR. CHICAGO, ILL.

JOHN MITCHELL. JOHN F. WEDOW. ALFRED MITCHELL.
MITCHELL & CO.
Vessel and Insurance Agents,
508, 509 & 510 Perry-Payne Building, Cleveland, O.
Office Telephone 767. Residence, John Mitchell, Doan 341.
John F. Wedow, 158 L. Alfred Mitchell, Doan 197 J.

W. C. RICHARDSON,
VESSEL AND MARINE INSURANCE AGENT,
Office Telephone 338. Residence Telephone 2938.
606 and 607 Perry-Payne Bldg., Cleveland, O.

BROWN & CO.
J. J. H. BROWN.
J. B. RODGERS.
EDWARD SMITH.
Vessel and Insurance Agents,
202 Main Street, Buffalo, N. Y.

H. J. PAULY,
General Ship Broker,
59 Chamber of Commerce, MILWAUKEE, WIS.
Telephone Main 369.

J. G. KEITH. D. SULLIVAN.
J. G. KEITH & CO.
Vessel and Insurance Agents,
138-139 Rialto Building, CHICAGO.
Long Distance Telephone, Harrison, 1339.

JOHN B HALL. HARRY B. ROOT.
HALL & ROOT,
Vessel Agents,
No. 55 Main Street,
Telephone Seneca 892. BUFFALO, N. Y.

ALEX. McDOUGALL. Telephone 89.
W. A. THOMPSON, JR. Cable Address: "Macduluth."
ALEX. McDOUGALL & CO.,
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AGENTS FOR
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M. M. DRAKE. G. W. MAYTHAM.
DRAKE & MAYTHAM,
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202 Main Street, BUFFALO, N. Y.
Telephone, Seneca 1660.

HUTCHINSON & CO.
Vessel and Insurance Agents.
Office Telephone, Main 2453.
Residence C. L. Hutchinson, Doan 19J.
C. L. HUTCHINSON. 412 Perry-Payne Building,
W. H. McGEAN. CLEVELAND, O.

J. H. BARTOW,
Vessel and Insurance Agent
514-516 Perry-Payne Building, Cleveland, O.
TELEPHONE 717.

THOS. WILSON, Managing Owner
Wilson's Transit Line.
Gen Forwarder, Freight and Vessel Agent,
CLEVELAND, O.

W. J. CONNERS,
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BUFFALO,
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MILWAUKEE,
GLADSTONE.
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U. S. Engineer Office, 185 Euclid Avenue, Cleveland, O., October 31, 1899. Sealed proposals for removal of wreck of schooner H. G. Cleveland and cargo, lying in about 50 feet depth of water in Lake Erie, near Cleveland Harbor, Ohio, will be received here until 2 p. m., standard time, November 10, 1899, and then publicly opened. Information on application. Jared A. Smith, Col., Engrs. Nov. 9.

U. S. Engineer Office, 1637 Indiana Ave., Chicago, November 2, 1899. Sealed proposals in triplicate for constructing three miles or less of Feeder of Illinois & Mississippi Canal, from mile 9 to 11, inclusive, near Tampico, Ill., will be received here until 12 noon, central time, December 2, 1899, and then publicly opened. Information furnished on application here, or to Assistant Engineer L. L. Wheeler, Sterling, Ill. W. L. Marshall, Maj., Engineers. Nov. 23.

U. S. Engineer Office, Montgomery, Ala., October 20th, 1899. Sealed proposals for building a sea-going hydraulic dredge will be received here until 12:00 M., November 22d, 1899, and then publicly opened. Information furnished on application. C. A. F. FLAGLER, Capt., Eng'rs. Nov. 16.

U. S. Engineer Office, Galveston, Tex., Oct. 16, 1899. Sealed bids, in triplicate, for deepening channel from Galveston Harbor to Texas City, Tex., will be received here until 2 p. m. Nov. 15, 1899, and then publicly opened. For information apply to C. S. Riche, Capt., Engrs. Nov9

U. S. Engineer Office, Montgomery, Ala., October 11, 1899. Sealed proposals for dredging on Carrabelle Bar, Fla., will be received here until 12 m., November 14, 1899, and then publicly opened. Information furnished on application. C. A. F. Flagler, Capt., Engrs. Nov9

U. S. Engineer Office, Montgomery, Ala., October 11, 1899. Sealed proposals for dredging in Apalachicola Bay, Fla., will be received here until 12 m., November 14, 1899, and then publicly opened. Information furnished on application. C. A. F. Flagler, Capt., Engrs. Nov9